ORIGINAL

IN THE UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

BALLY MANUFACTURING CORPORATION,

        Plaintiff/Counter-
        Defendant,

    vs.

D. GOTTLIEB & CO., a corporation,
and WILLIAMS ELECTRONICS, INC., a
corporation,

        Defendants/Counter-
        Plaintiffs.

No. 78 C 2246

DEPOSITION

of

PAUL DUSSAULT

CLAUDE W. YOUKER, JR.
OFFICIAL COURT REPORTER
U.S. DISTRICT COURT
UNITED STATES COURT HOUSE
ROOM 1918
CHICAGO, ILLINOIS 60604
312-427-4393

IN THE UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

BALLY MANUFACTURING CORPORATION,	)	
Plaintiff/Counter-Defendant,	)	
vs.	)	78 C 2246
D. GOTTLIEB & CO., a corporation, and WILLIAMS ELECTRONICS, INC., a corporation,	)	
Defendants/Counter-Plaintiffs.	)	

DEPOSITION of PAUL DUSSAULT, taken by

the plaintiff herein, pursuant to notice, before JULIE

A. CHURCHILL, (being a disinterested person, not of

counsel for, or employed by any or either of the parties

hereto, or interested in the outcome of said cause), a

duly Certified Shorthand Reporter and Notary Public of

the State of Illinois, at 135 South LaSalle Street, Suite

900, Chicago, Illinois, commencing on Tuesday, February 19,

1980, at 9:30 a.m.

PRESENT:

 FITCH, EVEN & TABIN
 (135 South LaSalle Street, Room 900
  Chicago, Illinois 60603) by
 MR. JEROLD B. SCHNAYER

  appeared on behalf of the Plaintiff/Counter-
  Defendant;

McDOUGALL, HERSH & SCOTT
(135 South LaSalle Street, Suite 1540
 Chicago, Illinois 60603)by
MR. MELVIN GOLDENBERG,

    appeared on behalf of the Defendant/Counter-
Plaintiff Williams Electronics, Inc.

A

MR. SCHNAYER: Would you swear the witness please?

PAUL DUSSAULT,

called as a witness by the Plaintiff herein, having been by me the said Julie Churchill as notary public aforesaid first duly sworn, was examined and testified as follows:

MR. GOLDENBERG: Before we commence, Mr. Dussault has with him this morning program listings to which he may have occasion to refer in the course of his testimony. In accordance with the agreement between counsel that he would have the right to do that, the listings as such will not be produced for inspection. I think the agreement is that that is a mutual understanding.

MR. SCHNAYER: Correct. Are these the programs which were produced -- not produced, but which were available to the prior witnesses at the depositions?

MR. GOLDENBERG: Yes, that is correct. One of them is.

MR. SCHNAYER: One of them is?

MR. GOLDENBERG: Yes. I had better let -- let me make a statement, and Mr. Dussault you correct

me if I am wrong. Mr. Fedesna did have available a program listing which I understood was the background.

MR. DUSSAULT: That is the original background.

MR. GOLDENBERG: The original background listing. Since that program was written, there had been modifications of it. I believe two modifications. So Mr. Dussault may have with him information about those two modifications, as well as the original one that Mr. Fedesna testified about. Is that correct, sir?

MR. DUSSAULT: I have one.

MR. GOLDENBERG: He has one of them.

MR. DUSSAULT: In addition to the original.

MR. SCHNAYER: In other words, you have two background programs: One is the original and an update of the original one?

MR. DUSSAULT: Yes.

DIRECT EXAMINATION

BY MR. SCHNAYER:

    Q   Could you please state your name for the record?

    A.   My name is Paul Dussault.

    Q.   How do you spell that, Mr. Dussault?

A.   D-u-s-s-a-u-l-t.

Q.   What is your current address,
Mr. Dussault?

A.   1060 Randville Drive, Palatine, Illinois.

Q.   What is the zip code?

A.   60067.

MR. SCHNAYER: Mr. Dussault is being
produced pursuant to a Notice of Deposition calling
for a designee by Williams under 30(b)(6) to testify
with respect to the computer software operations of
Williams' solid state pinball games, including Disco
Fever, is that correct?

MR. GOLDENBERG: That is correct.

MR. SCHNAYER: I would like to mark the
Notice of Deposition as BD 99.

MR. GOLDENBERG: I believe that Notice
of Deposition had attached to it a request for the
production of documents.

MR. SCHNAYER: That is correct.

MR. GOLDENBERG: As you are aware,
we have already produced documents in accordance
with that request as modified by various agreements
between counsel.   So no documents are being produced
at this time.

In addition, I would add, of course, the required 30 days was not provided for, but that is secondary.

(Whereupon, the document was marked

BD Exhibit 99 for identification.)

BY MR. SCHNAYER:

Q   Could you please summarize your educational background past high school?

A   I am a graduate of the University of Notre Dame in 1973. I have a BA in psychology.

Q   Did you attend any other universities past that?

A   No.

Q   Did you take any courses in electronics while at Notre Dame?

A   Yes.

Q   Generally, what type of courses did you take in electronics?

A   Just beginning electronics courses.

Q   Did you take any courses relating to computers?

A   Yes.

Q   What courses were those?

A   I took a computer program, Fortran

programming course.

Q   Any other courses relating to computers?

A   No.

Q   After leaving Notre Dame in 1973, were you employed?

A   Yes.

Q   With whom were you employed?

A   Addressograph Multigraph.

Q   During what years were you employed with Addressograph Multigraph?

A   In 1973 through 1977.

Q   Generally what were your duties and responsibilities with Addressograph Multigraph?

A   I was a technical representative and then a technical support specialist.

Q   More specifically, what did you do as a technical representative?

A   I serviced business machines.

Q   What type of business machines?

A   Computerized photo typesetters, keyboard units, input units.

Q   What were the keyboard units for?

A   They were to produce the input to drive the photo typesetters.

Q.   What were the inputs for?

A.   They were another type of unit that worked off of floppy disk rather than paper tape.

Q.   That is with relationship to the --

A.   Photo typesetters.

Q.   Photo typesetters.

        Did you do any design work with regard to that job?

A.   No.

Q.   What did you do specifically as a technical support specialist?

A.   I wrote service manuals, I answered field calls via telephone, and I also made field trips to repair the equipment.

Q.   Did any of that work involve design work?

A.   No.

Q.   Did any of that work involve programming a computer?

A.   Not officially.

Q.   When you say not officially, what do you mean by that?

A.   It was not part of my duties to be a programmer.

Q.   Did you do it not officially?

A.   Yes.

Q   Under what circumstances did you do it non officially?

A.   In order to write routines which would enable me to troubleshoot the equipment better than what was available, utility programs, diagnostic programs.

Q   What type of computer were you writing those programs for?

A.   There were two types. One was an Intel 8008. The other was called Amtrol II.

Q   How do you spell that?

A.   A-m-t-r-o-l II. That was a custom TTL computer which emulated an 8008.

Q   Is the Intel 8008 a microcomputer?

A.   Yes, it is.

Q   Was that used on the computerized photo typesetters?

A.   Yes.

        MR. GOLDENBERG: Off the record.

            (Discussion off the record after which the following further proceedings were had herein.)

        MR. SCHNAYER: Back on the record.

BY MR. SCHNAYER:

    Q   How did you learn to program the computer, the Intel 8008?

    A   Self-taught.

    Q   Did you take any courses?

    A   No.

    MR. GOLDENBERG: The witness said he was self-taught, Mr. Schnayer.

BY MR. SCHNAYER:

    Q   Did you have any other involvement while at Addressograph Multigraph with computers?

    A   No.

    Q   After leaving Addressograph Multigraph, with whom were you employed?

    A   Williams.

    Q   Do you know the exact date that you started working for Williams?

    A   October 17, 1977.

    Q   When you first started working with Williams, did you have any understanding of your duties and obligations at Williams?

    A   Yes.

    MR. GOLDENBERG: I'm sorry, could I have that question again?

(Question read by the reporter.)

MR. GOLDENBERG: Meaning his duties and obligations?

MR. SCHNAYER: Yes.

BY THE WITNESS:

A. Yes.

BY MR. SCHNAYER:

Q. What was that?

A. My duties were to be a technical writer and produce service manuals when I first joined Williams.

Q. Service manuals for what?

A. For the pinball machines.

Q. Prior to your working at Williams, did you have any other experience with computers beside what you have testified to?

A. No.

Q. Did you take any other courses relating in any way to computers?

MR. GOLDENBERG: The question has been asked and answered.

MR. SCHNAYER: You can answer.

THE WITNESS: The question again was?

(Question read by the reporter.)

BY THE WITNESS:

A.   No.

BY MR. SCHNAYER:

Q.   Who did you report to when you first started working for Williams?

A.   David Poole.

Q.   Who was David Poole at that time?

A.   He was the Manager of the Advanced Development Group.

Q.   Do you know who he reported to?

A.   He reported to Michael Stroll.

Q.   Who was Michael Stroll at that time?

A.   He was in charge of the Advanced Development Group.

Q.   When you started working for Williams, was there a project undertaken to design a solid state pinball machine prior to your arriving there?

A.   Yes, there was.

Q.   Could you please tell me prior to the time that you started working there what you learned about that development?

MR. GOLDENBERG: I think the question is indefinite. Do you mean what he learned about the project, what had occurred on the project before

he joined the company?

MR. SCHNAYER: Yes.

MR. GOLDENBERG: I object to the question as calling for hearsay.

BY MR. SCHNAYER:

Q. You can answer the question.

A. I really do not know how to answer that question. I went for a job interview and they showed me what they were doing. I took the job.

Q. What did they show you what they were doing?

A. They showed me the microcomputer, the solid state pinball machine.

Q. When you say they showed you the micro-computer, solid state pinball machine, what did they actually show you?

A. Yes.

Q. They showed you a machine that contained a microprocessor?

A. Yes.

MR. GOLDENBERG: Wait until the question is finished before you answer it.

THE WITNESS: Would you reread that question.

(Question read by the reporter.)

BY THE WITNESS:

A.   They showed me a working pinball machine.

BY MR. SCHNAYER:

Q.   What type of pinball machine was it?

MR. GOLDENBERG: Do you mean did it have a name or something like that?

MR. SCHNAYER: Yes.

BY THE WITNESS:

A.   I do not recall the name of the machine that was shown me.

BY MR. SCHNAYER:

Q.   Did they tell you anything about the work that they had done?

A.   Insofar as it pertained to the job I was applying for.

Q.   What did they tell you?

MR. GOLDENBERG: I object to the question calling for hearsay.

BY MR. SCHNAYER:

Q.   You may answer the question.

A.   They told me that they had completed work on the project and they were looking for someone to write the manuals, and that is the job that I applied

for.

Q.   The machine you saw, was that the only machine that was in existence that they had designed?

A.   That is the only one I saw.

Q.   Did you play with the machine at all?

A.   In what sense?

Q.   In any sense.

A.   I played a game on the machine, yes.

Q.   Did it operate?

A.   Yes.

Q.   Was it a self-contained machine?

A.   Yes.

Q.   Did it have any wires hooking up outside the machine beside the electrical cord?

A.   No.

Q.   Who were you talking to about this, about the machine?

A.   When I interviewed for the job?

Q.   Yes.

A.   Ron Crouse and David Poole.

Q.   Who was Ron Crouse at that time?

A.   Ron Crouse was the person who did the original software.

Q.   Did you actually start to prepare service

manuals for the pinball machine?

A.   Yes.

Q   How long did that take? How long were
you doing that function?

A.   Until about May, I believe, of '78.
Somewhere in that area.

Q   Prior to May of '78, did you do anything
else with regard to solid state pinball machines
beside work on producing service manuals?

A.   I played the games.

Q   Did you have any other job function?

A.   No. No. I would have to take that back.
I also taught service schools.

Q   These service manuals, those were manuals
on how to repair the game?

A.   Yes.   :

Q   Did you have to learn the operation of
the game in order to prepare the service manuals?

A.   Yes.

Q   How did you learn the operation of the
game?

A.   By physically looking at the game and
playing the game, and looking at the schematics, and
understanding how the game was put together, and how

it operated.

Q   Were you involved in any design of any portion of the solid state pinball machine?

A   No.

Q   Did you talk to any of the people that were working on the design of the solid state pinball machine about the work they were doing?

A   The project had been completed when I began.

Q   Do you know when the first solid state pinball machine manufactured by Williams went into production?

MR. GOLDENBERG: I object to the question. As the witness has testified, when he joined the company the design was complete, the game was in existence and I advise him he need not answer that. It would be pure speculation and hearsay on his part.

MR. SCHNAYER: You are advising him not to answer the question?

MR. GOLDENBERG: Yes, I am.

BY MR. SCHNAYER:

Q   Will you answer the question?

MR. GOLDENBERG: Just a moment.

(Discussion off the record.)

BY THE WITNESS:

A.   I will take my lawyer's advice.

BY MR. SCHNAYER:

Q.   I assume when your attorney instructs you not to answer a question, that you will take his advice and not answer the question for all subsequent questions if he so instructs you?

A.   Yes.

Q.   Were you involved prior to May of '78 in any way in programming a solid state pinball machine?

A.   No.

Q.   After May of 1978, what function did you have in relationship to solid state pinball machines at Williams?

A.   I became a game programmer.

Q.   When you say game programmer, what did you mean by that?

A.   I mean someone who codes the game to make it perform the way the game designer wants it to perform.

Q.   Do you have an understanding of what a foreground program is?

A.   Yes, I do.

MR. GOLDENBERG: Excuse me, in the context of Williams' terminology?

MR. SCHNAYER: Yes.

BY MR. SCHNAYER:

Q   What is that understanding?

A.   The concept of foreground as it is used at Williams is a collection of information which defines how a particular game plays.

Q   Did you have an understanding of the meaning of a background programming with relationship to Williams' games?

A.   Yes.

Q   What is that understanding?

A.   The background is a collection of information which is non-specific or non-game specific and contains some routines and other general purpose routines.

Q   Do the pinball machines that were produced by Williams contain background and foreground programs?

A.   Yes.

Q   Were you involved in programming foreground programs and background programs?

A.   At what time?

Q   Any time.

A.   I was involved with programming foreground
programs.

Q.   Was that with relationship to your
becoming a game programmer?

A.   Yes.

Q.   Do you have any understanding of how
the background programs operate for Williams pinball
machines?

A.   I would have to in order to be able to
do foreground programs.

Q.   Did you ever study the background programs?

A.   Yes.

Q.   What are your duties presently for
Williams Electronics?

A.   I am a game programmer.

Q.   Do you have a title presently?

A.   Not officially.

Q.   Do you have a non-official title?

A.   I am manager of the software.

Q.   Does anybody report to you?

A.   There are two people who report to me.

Q.   Who are those people?

MR. GOLDENBERG: Why is that relevant here?

MR. SCHNAYER: Who reports to him?

MR. GOLDENBERG: Yes, their names?

MR. SCHNAYER: Their names.

MR. GOLDENBERG: Wouldn't it be sufficient
if you got generally what their duties and responsi-
bilities were? I do not see what that has to do with
whether or not the patent is valid or has been
infringed.

MR. SCHNAYER: At some point it may be
necessary to call them and I would like to have all
the people who are working on the Williams games
presently. If you want to put it in the second book
I will do that.

MR. GOLDENBERG: I suspect we will.

MR. SCHNAYER: There is a protective
order entered in this case.

MR. GOLDENBERG: I am really troubled
by it, though. I am really troubled by it.

MR. SCHNAYER: Would you like to put it
in the second book?

MR. GOLDENBERG: We are going to go through
this anyway and probably put substantial portions of
it in the second book. Go ahead and answer the
question.

BY THE WITNESS:

A.   One of the names is Christina Rukuiza,

R-u-k-u-i-z-a.

Q   Who is the other person?

A.   Larry or Lawrence Demar, D-e-m-a-r.

Q   What are Christina Rukuiza's duties

presently?

A.   The same as mine, which is game

programmer.

Q   How about Lawrence Demar?

A.   The same.

Q   Whom do you report to presently?

A.   I report to Ward Allis. *Ellis (sic).*

Q   Who is Ward Allis? *Ellis (sic).*

A.   Vice President of Engineering.

Q   Do you know the games that have been

produced, solid state pinball machines that have

been produced by Williams Electronics?

A.   Yes, I do.

Q   Could you list them in the order that

they have been produced?

A.   Yes.

Q   Could you do that please?

A.   Hot Tip, Lucky 7, World Cup, Disco Fever,

Phoenix, Flash, Tri-Zone, Time Warp and Gorgar.

Those are all narrow-bodied games.

Q   And Williams has also produced wide-body

games, is that correct?

A.   That is correct.

Q   When would those have been produced in

that order? Let me reask the question.

            Could you tell me what the wide-body

games are?

A.   Contact, Pokerino, Stellar Wars and

Laser Ball.

Q   What was the game prior to Contact

being produced?

A.   They were manufactured concurrently.

Q   Concurrently with what?

                  bodies. PSD.

A.   The narrow boards.

Q   What game was that manufactured concurrently

with?

A.   I do not recall.

Q   How about Pokerino?

A.   Each of those games followed one after

the other, and I believe that Contact first appeared

when we did World Cup, in that span of time I think

is when that game came out, and they all followed

successively.

For example, Laser Ball is our present game, just as Gorgar is our present narrow-body game.

Q.   Which of the games that you have named contain substantially the same control circuit as is contained in the Disco Fever?

A.   What do you mean by control circuit?

Q.   Do you have an understanding of what control circuit means?

A.   I would like to know what you mean by control circuit.

Q.   Well do you have an understanding of what it means?

A.   I think you mean PC boards.

Q.   The solid state control circuit for pinball machines.

A.   Yes, okay.

Q.   That means microprocessors and all of the drivers and interconnects.

A.   Okay.

Q.   Could you answer the question?

MR. GOLDENBERG: Do you have the question?

THE WITNESS: No.

(Question read by the reporter.)

BY THE WITNESS:

A.   They all contain the same circuit.

BY MR. SCHNAYER:

Q.   All of the games that you have mentioned?

A.   All of the games that I have mentioned are basically the same.

Q.   Was there a change made in the solid state control circuit as to the microprocessor which is used?

A.   Yes.

Q.   What was that change?

A.   The change was from the 6800, the Motorola 6800 microprocessor to the Motorola 6802 or 6808 microprocessor.

Q.   What was the purpose of that change? Do you know?

     MR. GOLDENBERG: If you know.

BY THE WITNESS:

A.   One of the support circuits for the 6800 was not readily available. A clock chip.

Q.   Does the 6802 contain a clock chip internally?

A.   Yes.

Q   Does the 6808 also contain a clock chip internally?

A   Yes.

Q   What games contain either the 6802 or 6808?

A   I would say games subsequent to Flash. Flash and subsequent games.

Q   What wide-body games?

A   There may be some Stellar Wars, Laser Ball is, so it may have begun with Stellar Wars.

Q   Was there any program change for the background program of Williams' games when you changed from the 6800 to the 6802 or 6808?

A   No.

Q   Has there ever been a change of the background program for the solid state pinball machines?

A   Yes.

Q   When did that change occur, from what games?

A   There was a change for Flash and then there was a change after Flash. In the wide-body there would be -- there was a change on Stellar Wars and then there was a change on Laser Ball.

Q   Was the change that was made for Flash
the same that was made for Stellar Wars?

A.   Yes.

Q.   Was the change that was made for the
games after Flash the same as the change made for
Laser Ball?

A.   Yes.

Q.   Could you basically describe the change
that was made for Flash to the background program?

MR. GOLDENBERG: I'm going to object to
that question because I really think it is getting
into an area in which we agreed not to get into, and
it is getting into it by asking the witness questions
other than in examining these documents. As I under-
stand it from the notice, the purpose of this deposi-
tion was to find out how the game, the Williams games
work, and I certainly understood that to be inquiries
which would be helpful to you people in determining
whether or not there was infringement.

I do not see this kind of question
as leading in that direction at all, and I am going
to advise the witness not to answer it, and I think
you really should start putting questions to him in
accordance with your notice about how the Williams

games work from the point of view of the patents.
I think that is all you are entitled to know.

MR. SCHNAYER: What I am trying to do,
of course, is establish a background as to the
differences in the way different games operate. I
am trying to lay a background as to what some of
those differences are at this point, and see if the
witness is familiar with those differences.

Now the fact that a program change
occurred which would affect the operation of a game
is very important to the question of infringement
as to those games.

MR. GOLDENBERG: I think it is important
when it somehow relates to something the patent claims
as the invention. I think there may be other changes
which have nothing to do with the patent or its claims,
and I think your questions ought to be put in terms
of the patent and its claims. I think you have
established sufficient background about changes
generally, and I think it is now time to get to the
patent.

I am serious about this. If you
do not, I am going to adjourn the deposition and
ask for a protective order.

BY MR. SCHNAYER:

Q.   You will accept your attorney's
instruction?

A.   Yes.

MR. SCHNAYER: Mr. Goldenberg, I have
discovered that the last game I have manuals for
appear to be the Flash game, and I would make a
request that copies of manuals relating to the sub-
sequent games be produced, along with schematic
diagrams of those games.

MR. GOLDENBERG: I will take that request
under advisement. Mr. Dussault, have manuals been
published on all these games?

THE WITNESS: Yes.

MR. GOLDENBERG: What about the wide-body
games, Mr. Schnayer? Do you have the manuals for
those or any of them?

MR. SCHNAYER: No, I do not. I do not
have Contact, Pokerino, Stellar Wars, Laser Ball.

MR. GOLDENBERG: I will obtain copies
for you.

BY MR. SCHNAYER:

Q.   Have you been involved at all with the
Shuffle Alleys manufactured by Williams Electronics?

A.   In what sense?

Q.   In any sense?

A.   Yes.

Q.   What has your involvement with regard

to that been?

A.   I programmed the Shuffle Alleys.

Q.   Do the Shuffle Alleys contain foreground

programs and background programs?

A.   Yes.

MR. GOLDENBERG: Mr. Schnayer, is Bally

charging the Shuffle Alleys game with infringement

in this lawsuit?

MR. SCHNAYER: It is possible.

MR. GOLDENBERG: Until you tell me

definitely yes or no, I will not permit the witness

to answer anymore questions about it.

I believe you have been furnished

with service and operators manuals for those games

and are in a position to tell us what your position

is.

MR. SCHNAYER: We have been provided

with those manuals, yes.   We will get back to those.

BY MR. SCHNAYER:

Q   I show you copies of documents which

have been produced in this litigation by your

counsel. One of them appears to be a Williams

Disco Fever manual dated August, 1978 with Plaintiff's

Exhibit BD 39, and also with production number W462,

and ask you if you recognize that to be a copy of

something you've seen before?

A.   This is the Disco Fever manual.

Q.   I also show you a copy of a document

produced by your counsel in this litigation, which

has been previously marked as Plaintiff's Exhibit

BD 40, also containing production number W463 and

appears to be a set of schematics, and ask if you

recognize that as something you have seen before?

A.   Yes.

Q.   What do you recognize that to be?

A.   Those are the schematics for Disco Fever.

Q.   If I would ask you questions about the

operation of the Disco Fever, could you use those

schematics and this manual BD 40, and BD 39, to

answer questions?

A.   The operation of the game, yes.

Q.   I would like you to do that. I would

like you to examine any diagrams that are necessary,

and I am going to discuss with you and ask you

several questions on the operation of the Disco Fever

pinball machine.

MR. GOLDENBERG: You understand your

notice called for us to produce someone knowledgeable

with respect to the software aspect of the machine.

MR. SCHNAYER: I understand. In order

to describe the software of how the system operates,

it is necessary to lay a foundation as to what

components are in the system, if the witness has

knowledge of that, and how those components interact

with the software.

MR. GOLDENBERG: That is your view. I

am not too sure. Let's see how long it takes.

MR. SCHNAYER: This has been done with

several witnesses in the past.

MR. GOLDENBERG: This is a 30(b)(6)

witness produced in response to a specific statement.

Now as far as I can tell, you have not asked him

one question yet about the subject as defined in the

notice. Let's see how long it takes.

MR. SCHNAYER: It will take as long as

it has to take. This will be the procedure that I

will take, and this is the only procedure that can

be done with a complicated system of this fashion.

We have to go through the components of the system,

see if the witness is familiar with how they are

connected, and then determine how the software

operates.

MR. GOLDENBERG: You have gone over this

in endless detail before with other witnesses from

other companies. We are not going to go through it

again.

BY MR. SCHNAYER:

Q.   I refer you to Page 3 of BD 40, and ask

you if you recognize that schematic?

A.   Yes, I do.

Q   What is that a schematic of?

A.   It is a schematic of the PC board.

Q.   For what?

A.   For the Williams solid state games.

Q   Were you involved in any way in the

preparation of this schematic?

A.   As a matter of fact I was.

Q   In what way were you involved in the

preparation of the schematic?

A.   The schematics were originally done from

notes that I had drawn when I began doing publications.

Q   So you were involved in the preparation

of the entire document of BD 40?

A.   Yes.

Q   Were you also involved in the preparation
of document BD 39?

A.   Yes, I wrote this manual.

Q   You wrote the manual. Referring again to
Page 3 of BD 40, is there a CPU shown on that page?

A.   Yes, there is.

Q   Where is that shown?

A.   IC-1.

Q   What type of component is that?

A.   It is a Motorola 6800 microprocessor.

Q   What type of component is IC-21?

A.   IC-21 is a PROM, a bipolar PROM.

Q   When you say bipolar PROM, what do you
mean by that?

A.   It is a fusible link PROM. It can be
programmed to be any particular value that is
desired.

Q   What type of component is IC-22?

A.   IC-22 is also a bipolar PROM.

Q   Are IC-21 and -22 the memory locations
for the foreground program?

A.   Yes, they are.

Q.   What type of component is IC-20?

A.   IC-20 is a ROM.

Q   What type of component is IC-17?

A.   It is also a ROM.

Q   Are these the memory locations for the background program?

A.   Yes, they are.

Q   What type of component is the IC-13?

A.   IC-13 is a 6810 RAM.

Q   What type of component is the IC-16?

A.   It is also a RAM.

The function of an IC13 is a read and write memory device, which is used to keep track of various information that the microprocessor uses.

MR. GOLDENBERG: Let the record show that the drawing the witness is looking at states on its face with respect to each one of the items or chips about which the witness has been asked, what it is whether it is a RAM, PROM or ROM.

BY MR. SCHNAYER:

Q   Is that commonly called a scratch pad memory?

A.   Yes.

Q.   Is IC-16 also used for scratch pad

memory?

 A. Yes.

 Q What type of device is IC-19?

 A. It is a CMOS RAM.

 Q What is its function in this circuit?

 A. It is used for bookkeeping and factory
settings.

 Q When you say bookkeeping, what do you
mean by that?

 A. Audit totals, coin totals, number of
games played, numbers of games won, et cetera.

 Q Does the circuit shown on Page 3 contain
battery backup?

 A. Yes, it does.

 Q Where is that shown on the schematic?

 A. Batteries are identified as B-1, B-2 and
B-3.

 MR. GOLDENBERG: The witness pointed to
the right-hand side of the drawing, about halfway
down.

BY MR. SCHNAYER:

 Q What type of device is IC-2 on Page 3?

 A. IC-2 is a bidirectional transceiver,

8T28.

Q   What is its function in this circuit?

A.   It is a bidirectional gate.

Q   For what purpose?

A.   To pass information to the PIA or from

the PIA.

Q   Which PIA is that?

A.   PIA-1, which is IC-18.

Q   That is information from the CPU?

A.   Ultimately, yes.

Q   What is the function of the IC-5 on

Page 3?

A.   IC-5 is a Motorola 6875 clock generator

chip.

Q   Was that the chip that was replaced in

later games with the internal clock on the 6802 and

6808?

A.   Yes.

Q   What is the function of IC-10 on Page 3?

A.   IC-10 is also a bidirectional data

transceiver.

Q   Are IC-9 and 8 also bidirectional data

transceivers?

A.   IC-9 is. IC-8 is not.

Q   What is IC-8?

A.   It is simply a driver.

Q   Driver for what?

A.   It is a driver which is used to increase
the signals that come from the microprocessor.   It
is basically a one-way gate.

Q   What is the function of IC-23 on Page 3?

A.   IC-23 has two functions.   One of them
is a 1 millisecond timer generator.   The other is
a blanking circuit.

Q   Is that used to generate an interrupt
signal?

A.   Yes.

Q   What is the interrupt used for?

A.   It varies, depending upon which particular
background we are talking about.   In Disco Fever the
interrupt is used to present new information to the
displays, and it is also used to present information
to the lamps, and it is used for timing purposes.

Q   When you say IC-23 was used as a blanking
circuit, what do you mean by that?

A.   IC-23, the lower half is used to monitor
whether or not the processor is operating.   If the
processor does not operate or ceases to operate, it
will in turn cause blanking to occur.   Blanking will

then disable everything else in the game.

Q   Is there any other device which is used
to create an interrupt beside IC-23?

A   There is one other device, yes.

Q   What device is that?

A   Switch 1 and IC-24.

Q   Could you show me where that is?

MR. GOLDENBERG: The witness pointed to
the upper left-hand corner, about two inches down,
three inches down.

BY MR. SCHNAYER:

Q   That says F-1 diagnostic switch, is that
correct?

A   That is correct.

Q   You said IC-24?

A   Yes.

Q   What is that?

A   That generates a non-maskable interrupt.

Q   What do you mean when you say non-maskable?

A   That is a term that is used in the
Motorola 6800 language, commonly known as NMI. It
is not maskable. The microprocessor must respond
to this interrupt.

Q   What is that interrupt used for?

A.   It is used to initiate diagnostics.

Q.   I believe you said that IC-18 on Page 3
is a PIA. What type of device is a PIA?

A.   A PIA is a device which is used in the
Motorola family as an input or output device. It
is software configurable.

Q.   What do you mean when you say software
configurable?

A.   The microprocessor can establish whether
or not a given pin is an input or an output.

Q.   And those output pins are designated
what? Which pins could be used as either input or
output?

A.   The PA-0 through PA-7 and PB-0 through
PB-7, as well as control lines.

Q.   Which control lines are those?

A.   CA-1 and CA-2, and CB-1 and CB-2.

Q.   What is the function of PIA-1 on Page 3
in this circuit?

A.   PIA-1 is used to supply information to
the master display board, and to read information
from the dip switches on the CPU board, and from
the diagnostic switches on the coin door.

Q.   Which page in BD-40 shows the master

display board?

A.   Pages 8 and 9.

Q.   How many digital displays are there contained in the Disco Fever?

A.   There are five.

Q.   Are four of those a six-digit display and one a four-digit display?

A.   All five are six-digit displays. One of them is used only for 4 digits.

Q.   Are the digital displays in the Disco Fever multiplexed?

A.   Yes, they are.

Q.   When you say they are multiplexed, what do you mean by that?

A.   They are operated on a one out of 16 duty cycle.

Q.   What is the function of IC-6 on Page 3?

A.   IC-6 is a four to 16 decoder.

Q.   What are the outputs of IC-6 used to --

A.   They are used to select one of 16 digit pairs on the master display. They are also used to read the dip switch information on the CPU board.

Q.   Is the dip switch information read during any particular time of the operation of the game?

A.   It is only read during diagnostics.

Q.   Where do the outputs of IC-6 connect to?

A.   They connect to the master display board.

Q.   Where is that shown?

A.   It is shown on Page 8 on the upper left-hand side. I'm sorry, Page 9 on the upper left-hand side, identified as Strobe 1 through 16.

Q.   During the normal operation of the game, is there any particular order in which signals on the lines, Strobe lines 1 through 16?

A.   Yes, they appear Strobe 1 then Strobe 2, then Strobe 3, et cetera until 16. Then they repeat Strobe 1, Strobe 2 and Strobe 3.

Q.   Is the time between the appearance of a strobe on one strobe line and the time of the appearance on the next strobe line, is that time equal between strobes?

A.   Yes.

Q.   Is it also equal between the time that a strobe appears on Strobe line 16 and the next strobe appears on Strobe line 1?

A.   Yes.

Q.   What is that time approximately?

A.   One millisecond.

Q   That is continuous throughout the normal
operation of the game?

A.   Yes.

Q   Is there a reason for that?

A.   It allows us to effectively present the
information to the display with a minimum amount of
cost, they are multiplexed. It is a common technique.

Q   What is the function of the signals which
appear on output ports PB-0 through PB-7?

          MR. GOLDENBERG: On what device?

          MR. SCHNAYER: Device IC-18 Page 3.

BY THE WITNESS:

A.   PB-0 through PB-7 provide the BCD data
to the master display to select individual digits.

BY MR. SCHNAYER:

Q   To select, did you say, digits?

A.   Yes.

Q   How does it select individual digits?

A.   When a pattern appears on A-1, B-1, C-1
and D-1 lines, for example, --

Q   That is on Page 9?

A.   Yes. That would select a given number to
be displayed.

Q   The particular digit that was being

strobed at that particular time would light up with

that information, is that correct?

A.   Would light up with those particular

segments, that is correct.

Q   Now the signals that appear on A-1 through

D-1, those are BCD signals, are they not?

MR. GOLDENBERG: What page are you

looking at, sir?

MR. SCHNAYER: Page 9.

MR. GOLDENBERG: I do that so the record

can be clear. That is all.

BY THE WITNESS:

A.   Those are binary coded decimals.

BY MR. SCHNAYER:

Q   Those signals appear at the inputs of

IC-6 and IC-5, is that correct?

A.   They appear at one of those two devices.

Those devices are not in at the same time.

Q.   What type of device is IC-5 on Page 9?

A.   IC-5 is a BCD 27 segment decoder.

Q.   What type of device is IC-6?

A.   It is also BCD 27 segment decoder.

Q.   Is that the same for IC-7 and IC-8 on

Page 9?

A.   Yes, it is.

Q.   Why are there two circuits containing IC-5 and IC-6, BCD 7 segment decoders?

A.   To allow for two parts to be used, depending on which part is available.

Q.   So that therefore for any particular game, it would only contain one device: Either IC-5 or IC-6, is that correct?

A.   That is correct, and the note on Page 9 shows that:

"Use either IC-6 and 7 or IC-5 and 8. Do not intermix. Or use all four at the same time."

Q.   What type of device is IC-9 on Page 9?

A.   IC-9 is a driver.

Q.   What is it used for?

A.   It is used to shift the voltage levels from the TPL levels to the levels required for the gas discharge; i.e., plus and minus 100 volts.

Q.   Is the output of IC-9 connected to more than one display?

A.   Yes, it is.

Q.   Which display is it connected to?

A.   It drives pairs 2 and 4. I'm sorry,

pairs 1 and 2.

Q.   What type of device is IC-10 on Page 9?

A.   It is the same as IC-9. It is a driver.

Q.   What does it drive?

A.   It drives the segment for Players 3 and

4.

Q.   Doesn't IC-9 also drive the segments for
the display shown on Page 9 designated as GD-1?

A.   Yes, it does.

Q.   What is the purpose of the display in the
game?

A.   That display is called our master display.

Q.   What does it display?

A.   It displays credit information and ball
and play or match digits.

Q.   What is the function of IC-4 on Page 9?

A.   IC-4 is a digit driver.

Q.   Is that used to provide the appropriate
voltage to drive the various digits of the display?

A.   Yes, it is.

Q.   Are the circuits IC-13, 12 and 11 also
digit drivers?

A.   Yes, they are.

Q.   What digits does IC-13 drive?

A.   IC-13 drives player 4 and it also drives

digits in Player 3, which are also shown on this

schematic.

Q.   That would be the units *AND* *and* the tens digit,

is that correct?

A.   That is correct.

Q.   What digits does IC-12 drive?

A.   The remaining digits of Player 3, and

digits in Player 2.

Q.   What digit does IC-11 drive?

A.   The remaining in Player 1. I'm sorry, in

Player 2 and all of Player 1.

Q.   The appearance of a Strobe-1 on Page 9,

would that enable two digits simultaneously?

A.   Yes.

Q.   Likewise would that happen for the rest

of the strobe signals?

A.   It would except for Strobe 7 and 8, 15 and

16.

Q.   Would you describe the appearance of the

various signals to cause a number to be displayed on

the display GD-1?

A.   Yes, a particular strobe would have to be

selected. For example, Strobe No. 15 would have to

be a logic low. At the same time, information on the BCD lines A-1, B-1, C-1 and D-1 would have to be selected to display the appropriate number of segments to represent the digit desired. That would, in fact, turn on, if we were using Strobe 7 -- it would turn on the second digit from the right in the master display.

Q   My question is, what type of signals are generated to display an entire group of numbers? For example, for display GB-1. It is not just one number but a group of numbers.

A.   They are multiplexed so a group of strobes would have to be generated to do that.

Q   So first one strobe is generated that would enable one of the digits, and the appropriate BCD segment data would be applied to lines A-1 through D-1 to actuate the particular segments of that digit, and then the next digit would be enabled, and when the next digit is enabled, the BCD segment data would be changed in order to illuminate the various segments that are required to illuminate those?

A.   That is correct.

Q   And that continues and it repeats itself, is that correct?

A.   Yes.

Q.   And it cycles through all of the 16
strobes, lighting up the digits in sequential
fashion and repeating itself?

        MR. GOLDENBERG: I'm sorry, could you
have that read back?

                (Question read by the reporter.)

        MR. GOLDENBERG: Do you understand that?

        THE WITNESS: I have a problem with a
word "sequential" there.

BY MR. SCHNAYER:

Q.   It does it in some sequence?

A.   But not sequentially in that it works
its way across the digits necessarily because it
in fact does not.

Q.   When you say it does not work its way
across the deck what do you mean by that?

A.   When you refer to Page 13, there is a
diagram shown of the insert board wiring, which
shows the individual strobes required to illuminate
the particular digits of the particular players,
and the order in which they occur, Strobe 1 through
6 then 7 and 8, back on the master display. Then 9
through 14, then 15 and 16, back on the master display,

and then it repeats.

You will notice that Player 1 and Player 3 are both driven from the same strobe, but from different BCD numbers.

Player 2 and Player 4 are driven from the same BCD strobe but from different BCD numbers. Does that answer your question?

Q   Yes.

MR. SCHNAYER: Let's take a short recess here.

(There was a brief recess after which the following further proceedings were had herein.)

BY MR. SCHNAYER:

Q   What signals from the system shown on Page 3 are generated in order to produce the Strobes 1 through 16 for the digital strobes?

A   On IC-18, which is the PIA on the CPU board.

Q   On Page 3?

A   The lines PA-0 through PA-3 are used to give us one of 16 combinations. There are 16 binary conditions of these four lines. That information is transferred to IC-6, which in turn gives

us one of 16 strobes.

Q   What signals are generated by the micro-
processor to generate the outputs PA-0 through PA-3
in order to generate the strobe signals?

A.   The microprocessor just stores information
into that address. That is how it works.

Q   A microprocessor --

A.   Puts a number there, and that number
represents the condition of those four lines, and
those four lines go to 4 to 16 line decoder, and they
are decoded into one of 16 strobes. The number is
limited to being a four-bit number in that location.

Q   What signals are specifically generated
by the microprocessor which would instruct the PIA
to output those specific signals?

A.   The microprocessor stores a number into
the address of the PIA.

Q   How does it determine what number to
store?

A.   It keeps track in the scratch pad RAM
of which strobe should be stored.

Q   Is there a subroutine which is used to
determine which strobe should be generated?

A.   No.

Q   Is there an interrupt signal which is used
to instruct the CPU to generate signals which would
ultimately generate strobe signals?

A   Yes, there is.

Q   What interrupt signal is that?

A   The IRQ signal.

Q   How is the IRQ signal generated?

A   It is generated via device IC-23 on
Page 3, which generates a pulse approximately once
every 1.1 milliseconds or 1 millisecond.

Q   Where is that signal IRQ?

A   It is on Pin 4 of the microprocessor,
a line coming out of Pin 5 of IC-23 goes up and
around, and through and goes to Pin 4 of the micro-
processor.

Q   When a interrupt signal is generated,
what occurs?

A   When the interrupt occurs, the micro-
processor completes the current instruction that it
is operating on, and then as a function of the micro-
processor's internal structure, the condition of the
machine is saved on a stack, and then the microprocessor
vectors to an IRQ service routine where it will
perform the service routine for the interrupt.

Q.   That service routine, is that a subprogram?

MR. GOLDENBERG: Does subprogram mean

anything to you?

BY THE WITNESS:

A.   I do not know what you mean by the word

"subprogram".

BY MR. SCHNAYER:

Q.   What services will be performed by the

service routine?

A.   The service routine will update the

strobe information. It will display lamp information

and it will decrement counters, and act on counters

in the scratch pad.

Q.   So after an interrupt has occurred, the

microprocessor will enter the service routine and

generate signals to produce a digital strobe signal,

is that correct?

A.   That is correct.

Q.   And the next time the interrupt occurs,

the microprocessor will enter the service routine

and produce the next digital strobe, is that correct?

A.   That is correct.

Q.   And it will continue to do that throughout

the normal operation of the machine?

A.   Yes.

Q.   Does the interrupt that we have been talking about, the IRQ interrupt, have priority over other functions of the CPU?

A.   Only when the program allows it to.

Q.   Could you give me an example of a circumstance where the interrupt would not have priority?

A.   The interrupt can be inhibited.

Q.   Under what circumstances would it be inhibited?

A.   It could be inhibited during diagnostics. It could be inhibited during game play.

Q.   Could you give me an example of when during game play it could be inhibited? For what reasons?

A.   To turn coils on or to turn coils off.

Q.   Any other examples when it would be inhibited?

A.   When the machine was first initialized.

Q.   Any others?

A.   Not off the top of my head.

        MR. GOLDENBERG: Mr. Schnayer, if you are interested, the witness has advised me that he

could perhaps give you a more complete list, in addition to during game play, if he were to examine the game play listings.

MR. SCHNAYER: Could you do that please?

THE WITNESS: All right.

BY THE WITNESS:

A.   I am going to have to correct a statement that I said before. The inhibiting takes place at the beginning of the game, and then it also takes place upon entry to diagnostics. It does not take place when the solenoids are turned on in this particular background.

BY MR. SCHNAYER:

Q   Is there some portion of the program that you looked at?

A.   Yes.

Q   Some page? Could you give me a page and line number?

MR. GOLDENBERG: No, he cannot.

BY THE WITNESS:

A.   I looked through the background.

MR. GOLDENBERG: Be content with that, Mr. Schnayer.

BY MR. SCHNAYER:

    Q   I asked the question what page did you look at?

    MR. GOLDENBERG: And I advised the witness not to answer.

BY MR. SCHNAYER:

    Q   Do you accept your attorney's advice?

    A.   Yes.

    Q   Is there any other condition under which the interrupt is inhibited during the normal operation of the game?

    A.   The answer to that is not normally.

    Q   Do you have an understanding when I say normal operation of the game? Do you have an understanding of what normal operation of the game means?

    A.   By that I assume you mean while the game is being played, and the answer I am giving you is that that is not something which is fixed and has to be; and in fact, in different foregrounds, may or may not be inhibited as a selectable feature of the particular game.

    Q   It is controllable by the foreground?

    A.   Yes, it is also controllable by the

foreground as well as the background.

Q   But particularly for this game, the
Disco Fever, after examining the program you have
determined that --

A.   I have only examined the background for
Disco Fever. I have not examined the foreground.

Q   Could you do that?

A.   I will examine that if you would like.

Q   Would you do that.

(Brief interruption.)

BY THE WITNESS:

A.   This particular version does not inhibit
in the foreground.

BY MR. SCHNAYER:

Q   For what purposes could the program   --
foreground program be adjusted to allow the inhibition
of the interrupt signal during the normal operation
of the game?

MR. GOLDENBERG: Mr. Schnayer, does your
question go to the Disco Fever game or are you saying
in some other game?

MR. SCHNAYER: Any game.

MR. GOLDENBERG: Would there be a
circumstance where the foreground programs, software,

could inhibit this interrupt in some fashion?

BY THE WITNESS:

A.   Yes, there are.

BY MR. SCHNAYER:

Q   Under what circumstances would they
inhibit the interrupt signal or could they inhibit
the interrupt signal?

A.   As a function of a particular rule for
that particular game.

Q   For example, you mentioned previously
the turning on of the coils and the turning off of
coils. Could that be done?

A.   That could be done.

Q   Any other features?

A.   The game could be made to appear to go
dead on a tilt. The interrupt could be inhibited
then.

Q   Any others?

A.   That would be the most prevalent case.

Q   Therefore, for the Disco Fever during the
normal operation of the game, the strobe signals for
the digits appear in a certain order and continue to
appear in that order throughout the operation of the
game, is that correct?

A. During the operation of the game, yes.

Q. But for some other games, the time between the appearance of strobes on consecutive strobe lines for the digits may not be equal, is that correct?

A. That is correct.

Q. But the order of the appearance of the strobes on the various digital strobe lines would be always the same, is that correct?

A. Yes.

MR. GOLDENBERG: You are talking about Disco Fever?

MR. SCHNAYER: This is for any game.

BY MR. SCHNAYER:

Q. Is that how you understood the question?

A. I understood it for Disco Fever, but the answer is that with this particular hardware, that the answer would be yes. They would appear in successive order.

Q. Even if there was an interrupt that could inhibit, if there was a possibility of inhibiting the interrupt during the operation of the game, that order would remain constant during the operation of the game, is that correct?

A. It could.

Q   It could or would always?

A.   It could. If the -- for whatever reason in the foreground the order was chosen to be -- let's say it was at Strobe 14 and the foreground reinitialized the strobe number, it would rebegin at Strobe 1.

Q   Now I believe you also said that when the interrupt signal IRQ is generated, the microprocessor would vector to the IRQ service routine where it would service -- where it would perform the service of the interrupt which included display lamp information?

A.   That is correct.

Q   What do you mean when you say display lamp information?

A.   Our microprocessor controls lamps are arranged in 8 by 8 matrix, eight rows and eight columns.

As part of the interrupt service routine, the microprocessor will output every other strobe a new column and new row information, which will give us a one out of eight duty cycle on our lamps.

Q   When you say the microprocessor would output every other strobe, what do you mean by that,

by every other strobe?

A.   I mean on every other strobe it would put out new information for lamps. Lamp information is held for two strobes, and then it is updated or changed.

Q.   And each of those strobes would be generated during the occurrence of an interrupt?

A.   Yes. Those strobes being what specifically?

Q   Those strobes being for the lamps?

A.   Okay, they are not called strobes in the lamps.

Q   What are they called?

A.   They are called columns.

Q   Are they called columns --

A.   Just columns.

Q   Just columns.

A.   Yes, there are eight columns.

Q   Are they called column drives?

A.   Pardon me?

Q   Are they called column drives?

A.   I suppose you could call it a column drive. The microprocessor only knows them as rows and columns. It could care less what the hardware is.

Q   Where is the PIA shown on the schematics?

MR. GOLDENBERG: What PIA?

MR. SCHNAYER: Let me finish my question.

BY MR. SCHNAYER:

Q   BD-40, which is used to generate signals
to actuate the lamps?

MR. GOLDENBERG: I object to the form of
the question. There has been no testimony that the
PIA generates signals to actuate the lamps.

MR. SCHNAYER: You can answer the
question.

MR. GOLDENBERG: No, he cannot answer
the question.

MR. SCHNAYER: He can answer the question.

MR. GOLDENBERG: Rephrase it. I object to
the question as to form. I would ask you to rephrase
the question.

MR. SCHNAYER: I would like an answer
from the witness.

MR. GOLDENBERG: I advise him not to
answer. I invite you to rephrase it properly.

MR. SCHNAYER: If he did not understand
it he can tell me.

Dussault - direct

BY MR. SCHNAYER:

Q   Do you refuse to answer the question?

A   After all the talking, I do not remember what the question is.

MR. SCHNAYER: Would you repeat the question please?

(Question read by the reporter.)

MR. GOLDENBERG: Reread my objection also.

(Record read by the reporter.)

MR. SCHNAYER: Are you instructing him not to answer?

MR. GOLDENBERG: Yes.

MR. SCHNAYER: Are you instructing him not to answer?

MR. GOLDENBERG: I think it will be the third time, sir. If you would listen, it would be helpful in these matters.

BY MR. SCHNAYER:

Q   Could you tell me the function of PIA-3, Page 5, BD-40?

A   PIA is a lamp PIA.

Q   When you say lamp PIA, what do you mean by that?

A   It is a PIA which interfaces the lamp

matrix to the microprocessor.

Q   What is the purpose of the signals which appear at ports PB-0 through PB-7?

MR. GOLDENBERG: Of PIA-3.

MR. SCHNAYER: Of PIA-3 on Page 5.

BY THE WITNESS:

A   Those signals select which particular column is enabled or activated.

BY MR. SCHNAYER:

Q   What is the function of the signals which appear at ports PA-0 through PA-7 of PIA-3, Page 5?

A   Those lines are used to select which of the rows in the matrix are to be turned on or enabled.

Q   Is there any particular order which the columns are activated during normal operation of the game?

A   Are you referring to the background or the foreground?

Q   The background.

A   They are operated from Column 1 through Column 8.

Q   So a signal appears on Column 1 and then sometime later a signal appears on Column 2,

and that continues through Column 8, is that correct?

A   Yes.

Q   And then it repeats itself Column 1 through Column 8, and repeats itself again?

A   Yes.

Q   I believe you said previously that the lamp information is held for two strobes?

A   That is correct.

Q   Does that mean that the lamp column is activated for two strobe signals?

A   That means that a column and a strobe of rows are energized for two strobe signals, that is correct.

Q   Do they remain energized for those?

A   Yes, they remain energized. They are actually turned on.

Q   What is the time period that a column is activated?

A   Two milliseconds.

Q   What is the time between the appearance of an activation on one column and the activation on another column?

A   I am sorry, I missed part of that question because of the page. Would you read it back?

(Question read by the reporter.)

BY THE WITNESS:

A.   It is on the order of microseconds.

BY MR. SCHNAYER:

Q.   Why is each column activated for two strobe signals?

A.   Because of the duty cycle that is used on the lamps. It is a one out of eight duty cycle.

Q.   Why couldn't a single strobe be used and also have a one out of eight duty cycle?

MR. GOLDENBERG: I object to the question. Let's deal with the equipment that we have in front of us, sir. There is no need to speculate about things that do not exist.

BY MR. SCHNAYER:

Q.   You can answer the question if you know.

MR. GOLDENBERG: Go ahead and answer the question.

BY THE WITNESS:

A.   The duty cycle was chosen to be one out of eight just because of the way the hardware was designed. That is the voltage that they selected for the lamps and the types of lamps and the circuitry that was designed.

Q   Where are the lamps shown in the schematics

BD-40?

A.   They are shown in two places. They are

shown on Page 12 in the section which is identified

as playfield lamp matrix or playfield lamp wiring

diagram, and they are also shown on Page 13 in the

section identified as insert board wiring.

Q   Are the lamps which are shown on Page 12

and 13 all in a common matrix?

A.   Yes, they are, which is more readily seen

in BD-39 on Page 25.

Q   If one would want to illuminate Lamp 8B9

and 8B10 on Page 12, what type of signals would

appear on the input lines and output lines to the

lamp matrix?

A.   The Column 2 driver would have to be

energized and Rows 1 and 2 drivers would also have

to be energized.

Q   How does the microprocessor, when an

interrupt occurs, know which lamps are to be

illuminated?

A.   There is a representation of the lamp

matrix in the scratch pad RAM.

Q   Does the microprocessor after the

interrupt has been generated examine the representa-
tion of the lamp matrix in the scratch pad RAM to
determine which lamps are to be actuated and generate
signals to the appropriate PIA to actuate those lamps?

A.   No, it does not examine the lamp matrix.
It takes the contents of the lamp matrix representa-
tion and applies to the PIA.

Q.   Referring to Page 5, what is the function
of the circuitry which is connected to the line PB-0?

A.   The circuitry consists of IC-13, which is
an and AND gate. It consists of 2N6427 Darlington
transistors, and a Tip 22 Power Transistor. The
AND gate is gating the signal from PB-0 and the
blanking signal which comes from the CPU board, and
when those signals are both active, will turn on the
Darlington transistor, which in turn will turn on
the power transistor, which will then apply the
voltage, the lamp VCC voltage to one side of all the
bulbs which are connected in that lamp column.

Q.   What is the blanking signal that you just
mentioned?

A.   The blanking signal is the signal which
is generated on the CPU board and serves as a monitor
of microprocessor activity.

When the microprocessor stops for whatever reason, the blanking signal is no longer present and consequently all power devices are inhibited. Lamp columns cannot be active. Switches do not work, displays no longer work, solenoids no longer work.

Q   Why is that signal provided for?

A.   It is provided to prevent the devices from burning up if the microprocessor should fail. It is a safety feature.

Q.   What are the functions of the circuit elements connected to the line PA-0 of PIA-3 Page 5?

A.   Those elements are the elements which supply the current for the particular lamps that are at the intersection of the columns and the rows that are energized. They actually supply the ground for the RAM. The column supplies the voltage, the row supplies the ground. A bulb at the intersection will illuminate.

Q   Due to the architecture of the system, the fact that the interrupt is used for both the digit strobes and the column driver signals, there is a relationship between the appearance of the digit driver signals and the column driver signals, is there

not? Is there?

A.   The relationship exists in the way that
the program was written.

Q   And the digital strobes will appear at
twice the occurrence of the appearance of the enable
of the column drivers, is that correct?

A.   That is correct.

Q   And that will continue throughout the
normal operation of the game, is that correct?

A.   Yes.

Q.   Is there any point during the operation
of the game that that will not occur?

MR. GOLDENBERG: You are talking about
Disco Fever?

MR. SCHNAYER: Yes, at this point.

BY THE WITNESS:

A.   During diagnostics, the strobing -- all
strobing can be inhibited, as well as other portions
if desired in the foreground. In Disco Fever it was
not done in the foreground, but it could also be
done there. These are all software controllable
items and consequently with the appropriate code,
can be made to act in any manner desired.

Q   Now we have been discussing the operation

of digits, digital displays, and also the operation

of the lamp drive circuitry, is that correct?

A.   Yes.

Q   And we have been discussing it specifically

with regard to the Disco Fever game, is that correct?

A.   That is correct.

Q   Would there be any difference in the

operation of the circuitry for any of the subsequent

games which has been manufactured by Williams?

A.   There are a number of software differences.

The hardware did not change but the software did.

Q   Were those software differences the ones

that you talked about earlier with regard to the

Flash game and the games after the Flash game?

A.   Yes.

Q   Would those software differences in any

way change the operation of the game as we discussed

it?

        MR. GOLDENBERG: I think you should be

a bit more specific than that.   Perhaps break that

question up into parts as to whether you are going

to the digit drivers or the lamp displays.

BY MR. SCHNAYER:

Q   Specifically did the software changes

that were made in subsequent games affect the

operation of the lamp drive circuitry the way we

discussed it for the Disco Fever?

       MR. GOLDENBERG: You mean as the witness

testified to it?

BY MR. SCHNAYER:

    Q   As you have testified to it.

    A   The only question or only doubt in my

mind is the order in which the lamp columns would be

done. The digit strobes were done in the same order.

The lamp columns may have been reversed. I will

consult with the listing for that.

       MR. SCHNAYER: Okay.

        (Brief interruption.)

BY MR. SCHNAYER:

    Q   Now this is a listing for subsequent

games?

    A   Yes.

    Q   What game is it for so I know what we

are talking about?

    A   It is for the games after Flash. I am

going to consult the background and not the foreground.

    Q   You have both the background and the

foreground for that subsequent game?

Dussault - direct

A.   Yes.

MR. GOLDENBERG: Games I think is what
the witness has said.

BY MR. SCHNAYER:

Q   Does the program have a specific name so
that at a subsequent time if you are called to
testify again, we know that is the program you
testified with respect to.   Does it have a number?

A.   The background is identified by a part
number 5A9233 and 5A9234.

Q.   5A923?

A.   5A-9234.

Q.   Does it have a heading on the top of
that program?

A.   Yes.

Q   What is that heading?

A.   BK-9233.

Q   Does it have a date?

A.   It is dated August 24, 1978.

Q.   Now this is the background program we're
talking about?

A.   Yes.

Q   How many pages are contained in the program?

MR. GOLDENBERG: I object to the question

and advise the witness not to answer.

BY MR. SCHNAYER:

    Q.   Is there also a foreground program?

        MR. GOLDENBERG: Foreground program where,

sir?

BY MR. SCHNAYER:

    Q.   That you have brought a new foreground

program which has not previously been brought to

any of the depositions?

    A.   There is a foreground program which is

part of this background list.

    Q.   Do you know what game that is for?

    A.   It is for a game which -- this particular

version was not released.

    Q.   Does that have a particular designation

on the top of that foreground program?

    A.   It is identified as FG9233.

    Q.   Does it have a date?

    A.   No, it is part of the entire listing.

The columns are also done from 1 through 8 in the

9233 background.

    Q.   That is the columns of the lamps?

    A.   Yes.

    Q.   Is that a chart of how the games operate?

You were just examining something?

A.   This is a Motorola Instruction Set Summary for the M-6800 microprocessor family. I will be very specific. We discussed in the system how the signals were generated to generate the various column drive enables for the lamp matrix, and for the Disco Fever, is the operation of the games that were subsequent to Disco Fever --

Q   Do they also produce those signals in the same way?

A.   Well the microprocessor produced them in both cases, so the answer to that would be yes. The way that the microprocessor got to where it gets to actually produce that is different.

Q   My question is in what way is it different in different games? For different games is that different?

A.   The order that the columns are displayed is not different. How the columns are actually arrived at is dependent upon the background, and differs from Disco Fever to the background which is currently being used.

Q   At some point were the changes made in the background program which would determine how

the columns were arrived at in some particular game

that was produced by Williams?

A.   When the background was revised.

Q.   That occurred for the Flash?

A.   It occurred for the Flash and then it

also occurred just after Flash for part of Flash.

Q.   Referring specifically to the Flash, are

you familiar with the operation of the Flash game?

A.   Yes I am.

Q.   Are you familiar with the software

operation of the Flash game?

A.   Yes, I am.

Q.   Could you tell me the differences and

how the columns are arrived at in the Flash game

versus the Disco Fever game?

A.   In Disco Fever the background which is

used is identified as 5A9007 and 9008. In Flash

it is identified as 9233-34 background. They

contain different code. They accomplish the same

purpose but they are doing it differently.

Q.   My question is how were they doing it

differently?

A.   They were using different locations in

RAM, the scratch pad RAM. They were using different

internal registers, possibly different operations
internal to the microprocessor. Different instructions
to accomplish the same end.

For example one *the* 9008 uses an
instruction identified as arithmetic shift left B,
and the 9233-34, the same process is used with an
arithmetic shift left A. They are functionally
equivalent but they are different instructions.

Q We discussed previously for the Disco
Fever how the interrupt signal was generated. Is
the interrupt signal generated in the same fashion
for the Flash game?

A. Not for the entire production run.
There are a number -- there are three different
versions of the CPU board. The most common version
is identified by a -4 version, and that is in fact
the schematic that we have been looking at in the
exhibit.

Q. That is the schematic --

A. On BD-40, 2 is the actual layout of
the board and 3 is the actual schematic.

On Pages 2A and 3A there is an
alternative version of that same board, which allows
for expanded memory and in addition to that, there

is a version which is identified as a -6 CPU board,
which rather than incorporating the 6800 micro-
processor, incorporates a 6802 microprocessor.

The IRQ is derived differently in
that -6 board than in the -4 board.

Q   How is it arrived at on the -6 board?

A.   It is arrived at as a result of a divide
on the clock crystal. The clock crystal is actually
counted down, and when the count reaches a certain
number, the count is reset and the interrupt occurs.

Q   When the interrupt occurs, is that used
in the same way by the CPU of the Disco Fever to
generate the various strobes for the digits and the
enables for the lamp matrix as it is in the Flash?

A.   The end result: i.e., what is actually
displayed and what is seen on the lamps is done --
the end result appears to be the same. The actual
instructions which it takes to accomplish that are
different.

Q   Why are those instructions different?

A.   Because it was a revision of the background,
and when the background was revised it was reorganized,
and because of the reorganization, that means that
things are done in a different fashion.

Q   Upon the occurrence of an interrupt for
the Flash game, does the microprocessor vector to
AN *PSD*
~~and~~ IRQ service routine?

A   Yes, it does. That is a hardware
function of the microprocessor. That is the way
the microprocessor operates.

Q   And in the service routine it will
perform the various services for the interrupt,
for the Flash game, is that correct?

A   Yes, except that in Flash, what is done
during the interrupt differs from what is done in
Disco Fever.

Q   In what way specifically does it differ?

A   It differs in the actual code, which was
written to accomplish that, the locations that were
used, the instructions that were used, and it also
differs in the types of things that were done during
the interrupt services. For example, in the Flash
and subsequent background, the switches are scanned
on the interrupts. In the Disco Fever and previous
games, switches are not scanned as part of the
interrupt.

Q   For the Disco Fever, when are the
switches scanned?

A.   The switches are scanned when the micro-

processor is going through what is called the

executive loop.

Q.   What is the executive loop?

A.   The executive loop is the main control

for the entire pinball machine. It is a series of

steps that the microprocessor takes one after the

other, and then acts upon different information

that it discovers when these steps are taken, and

once these steps have been completed, it repeats

that process.

Q   And it continues to repeat it unless an

interrupt is --

A.   Unless an interrupt or other action is

requested. For example, if a switch is read or if

a coil is timed out and it is the time to turn a

coil off or the time to alternate the condition of

a bulb, or a number of things.

Q   For the Flash and subsequent games, when

you say the switches are scanned during the occurrence

of the interrupt, are the switches scanned entirely

or just one row?

A.   They are scanned entirely. There is a

restriction on that answer in that it is dependent

upon whether or not any switches have been closed.
If another switch is closed in a particular column,
scanning will cease when it finds that that switch
is closed in that column. That was not true of the
Disco Fever background and the scanning was done in
a different manner in Disco Fever.

Q. For the Flash and subsequent games,
during the scanning of the switch matrix, after an
interrupt has occurred, and a switch is detected on
one of the columns, does the scanning of the switch
matrix continue until it is complete for all the
switches?

A. No.

Q. So it stops at that point?

A. That is correct.

Q. When that switch closure is read and then
that switch closure is stored someplace in the scratch
pad memory, is that correct?

A. That is correct.

Q. Then the scanning of the switch matrix
is stopped until the occurrence of the next interrupt
signal, is that correct?

A. That is right.

Q. When the next interrupt signal occurs,

the matrix is scanned again and if there is no

switch closure detected, then it will complete

the entire scanning of the matrix, but if a switch

is detected, it will only scan a portion of the

matrix, is that correct?

MR. GOLDENBERG: Could you read that

back? That was more of a speech than a question.

(Question read by the reporter.)

BY THE WITNESS:

A. Most of that statement is correct.

The part of the statement which is not correct is

that when the next interrupt occurs -- that part

is not correct.

Q What happens when the next interrupt

occurs?

A. The switches are not scanned on every

interrupt.

Q. They are scanned on what interrupts?

A. They are scanned on every other interrupt.

Q. Is it therefore not possible that a

switch closure could be missed?

A. If a switch closure occurs in milliseconds,

it could be missed. Or if a switch closure occurs

during the portion of time that the scan is inhibited,

that is another feature of the background.

Q   Then a switch closure would also be missed?

A.   Yes.

(There is a discussion held off the record after which the taking of the deposition was recessed until 2:00 o'clock p.m.)

IN THE UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

BALLY MANUFACTURING CORPORATION,)
)
       Plaintiff/ Counter-)
       Defendant,)
)
)   78 C 2246
  vs.)
)
D. GOTTLIEB & CO., a corporation,)
and WILLIAMS ELECTRONICS, INC., a)
corporation,)
)
       Defendants/Counter-)
       Plaintiffs.)

The taking of the deposition of

PAUL DUSSAULT was resumed at 135 South

LaSalle Street, Room 900, Chicago, Illi-

nois, as follows:

PRESENT:

   MR. JEROLD B. SCHNAYER

   MR. MELVIN GOLDENBERG

PAUL DUSSAULT,

called as a witness by the Plaintiff, having been previously duly sworn, was examined and testified further as follows:

MR. SCHNAYER: Prior to the break we discussed the fact of whether we had any contentions with regard to the Shuffle Alley.

MR. GOLDENBERG: Yes.

MR. SCHNAYER: We do contend that the Shuffle Alley may infringe some of the claims, and therefore we would like to ask questions about the operation of the Shuffle Alley. I believe that that is all that really is necessary at this point.

MR. GOLDENBERG: I do not believe so, sir.

MR. SCHNAYER: So you are going to instruct the witness not to answer?

MR. GOLDENBERG: My position remains the same. You take a position on it and charge it with infringement, and then we will deal with it. You can be more unequivocal than that.

MR. SCHNAYER: I think that is all that is necessary at this time to make a statement as to that.

MR. GOLDENBERG: We disagree.

MR. SCHNAYER: You will not allow the witness to answer any questions regarding Shuffle Alley? You will instruct him not to answer any questions regarding Shuffle Alley, is that correct?

MR. GOLDENBERG: I believe that is what I said.

MR. SCHNAYER: That is the position you are taking now?

MR. GOLDENBERG: I believe that is what I said.

MR. SCHNAYER: But you will instruct the witness, if I ask any questions, not to answer any questions --

MR. GOLDENBERG: I believe that is what I said. Is there any doubt in your mind?

DIRECT EXAMINATION

BY MR. SCHNAYER:

Q.   Were you involved in the programming changes that were made to the background program of the Flash?

A.   No.

Q.   Who was involved in those changes?   *PFEIFFER*

A.   A gentleman by the name of Randy Fifer.   *P.H.D*

Dussault - direct

Q. Who was Randy Fifer [PHEIFFER] at that time?

A. He was a game programmer at that time.

Q. Do you know who Randy Fifer [PHEIFFER] is now?

MR. GOLDENBERG: I think he is still Randy Fifer [PHEIFFER].

BY MR. SCHNAYER:

Q. What position?

A. He is no longer employed at Williams.

Q. Do you know where he is now?

A. He is in California somewhere.

Q. Do you know with what company?

A. No, I do not.

Q. Do you know what part of California?

A. No.

Q. Do you know when he ceased to be employed with Williams?

A. It has been over a year.

Q. Were you involved in any way in the programming of the background program for Flash in any way?

A. Yes.

Q. What way were you involved with it?

A. I contributed ideas to the structure.

Q. When you say structure, what do you mean?

A.   The way things are organized and why things
were done a certain way.

Q.   When you say the way things were organized,
and why things are done in a certain way, what do you
mean by that?

A.   I mean the background has a structure and
certain things were done in certain ways so the
code was written to accomplish the means, but how
the code was written was, you know there are a lot
of ways to write the code to accomplish the same
thing.

Randy and I discussed it and in
fact went through some of the areas as to how things
were organized in the background, and what things
would be easiest to implement, and the easiest way
to do it.

Q.   Do you have an understanding as to why
you were doing this, changing the background?

A.   Yes.

Q.   What was that understanding?

A.   The reason the background was changed
was in order to improve the background to make it
more flexible and more powerful, and to allow for
features which were not easily implemented in the

original background.

Q.   What type of features were not easily implementable in the previous type program?

A.   One of them is the use of what are called cyclers.

Q.   What is a cycler?

A.   A cycler is something which happens at a fixed rate. It can be an operation to a lamp, it can be an operation to a solenoid, it can be a sound.

Q.   How were those implemented in the background program for Flash?

A.   Those features were incorporated in Flash background, they had not been present in the background prior to that.

Q.   Why did you change the manner in which the switch matrix was scanned in the Flash game as opposed to the games prior?

A.   Because it was felt that the scanning of the switches could be done more efficiently on an interruptive basis, and that the microprocessor could spend its time more efficiently in the executive loop rather than scanning switches.

It was not necessary to scan

switches every 50 microseconds, or a hundred

microseconds because switches do not operate that

quickly in the real world.

Q   When you undertook to make the program

PHEIFFER

changes for the background with Mr. Fifer, were

there any criteria that you were given by anybody

to follow?

A.   The only criteria was that the existing

hardware had to work with the new software.

Q   When did you first start to undertake

these changes?

A.   I do not recall the exact date.

Q   Approximately?

A.   February of '78. March of '78, in that

area.

Q   When were the changes completed?

A.   Well the background -- I may have to

take that back. The date that we had on this

particular listing is August 24, 1978. That is

for the current background. That date would probably

also be the date that was used for the background

just prior to this one, the Flash background. Flash

went into production in January of '79. February

of '79.

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It went through July of '79, so that means that the background prior to the 9233-34 background was completed in August of '78 and released for ROM. The 9233-34 background was revised and completed after that period of time, but I cannot give you an exact date.

Q   So it was approximately in August?

A   It would be in '78, you know, the latter part of '78. I'm not sure. I could go back into our records and see when the code was actually released to the raw manufacturers, and that would constitute the completion of the fore-or background. The same thing would be true for the 9196 and 9197 background.

Q   Are you familiar with the fact that a patent has issued to Bally and that that patent is the subject matter of this lawsuit?

A   Yes.

Q   Have you ever seen a copy of the patent?

A   Yes.

Q   When did you first become aware of the fact that a patent was in existence?

A   Sometime last year.

Q   Sometime in '79?

A.   Yes.

Q   So you were not aware of the fact that a patent had issued in '78?

A.   Whenever the patent proceedings began is when we were informed of the fact that there was a patent.

Q   How do you know when the patent proceedings were started?

A.   I do not remember the exact date.

Q   Do you remember when the patent proceedings were started that you became aware of the patent at that time?

A.   Yes.

Q   How did you know that it was when the patent proceedings were started that you became aware of the patent?

A.   Because we were given a copy of the patent to review.

Q   Who gave you a copy of that patent?

A.   Dave Poole, who was the manager.

Q   When he gave you the copy of the patent, what did he say to you?

        MR. GOLDENBERG: I object to the question, the reason being that any conferences between Mr. Poole

and those who were reporting to him were in connection with developing information whereby Williams' attorney could consider the matter and prepare for the defense of the lawsuit. Therefore, I claim privilege for such statements and advise the witness not to answer.

BY MR. SCHNAYER:

Q.   Was an attorney present at the time you were given the patent?

A.   Not that I recall.

Q.   Did you ever discuss the fact that you were being given the patent pursuant to discussions with an attorney and instructions by an attorney?

A.   We were informed that there was a lawsuit and that is why we were given a copy.

Q.   Were you informed that the attorneys had given specific instructions to show you copies of those patents?

A.   I believe so. We were given the patents because the lawyers went through my manager and all the people who were involved and we were asked to review the patent because we were involved in a lawsuit. That is about all I remember of the initial patent and that is about the last time I looked at it.

Q.   Did somebody tell you that a suit had

just recently been filed when you were given a

copy of the patent?

A.   I do not remember if they said it had

just recently been filed. They said that a suit

had been filed and that this was the patent, and

I was asked to look at it.

Q   Were you told why you were asked to

look at it?

MR. GOLDENBERG: I object to that

question for the reasons previously stated and

advise the witness not to answer.

BY MR. SCHNAYER:

Q.   Do you accept your attorney's instructions?

And you will continue to do so and refuse to answer

those questions?

A.   Yes.

Q   When you got the copy of the patent,

did you look at it?

A.   I read the patent as I have just stated.

Q   Did you discuss it with anyone beside

Mr. Poole?

A.   We discussed it in the engineeing group

of people who were given the patent to read and

discuss the patent.

Dussault - direct

Q   Did you discuss it in relationship to any work you were doing at Williams?

MR. GOLDENBERG: I object to that question. I think you have established that there was a discussion and the purpose of it, and I think that is all you are entitled to know. I think if you want to ask with whom he discussed it, I would have no objection to that. But I think any further questions would be out of order.

MR. SCHNAYER: Would you read back my question please?

(Question read by the reporter.)

MR. GOLDENBERG: I advise the witness he need not answer that question.

BY MR. SCHNAYER:

Q   Were you instructed by anyone at Williams to determine whether you could design a control circuit for a pinball machine which would not infringe the patent?

MR. GOLDENBERG: I object to that question on the ground of relevancy, not being likely to lead to the discovery of admissible evidence.

BY MR. SCHNAYER:

Q   You may answer the question.

A.   No.

Q   Were you ever involved in any discussions
where it was suggested that it be determined whether
the Williams control circuit could be modified so
that it did not fall under the claims of the patents?

MR GOLDENBERG: Could I have the question
again please?

(Question read by the reporter.)

MR. GOLDENBERG: Do you understand the
question?

THE WITNESS: I think the question says
was I involved in any discussions about the patent
and our system and how to change our system so that
it would not infringe the patent.

MR. SCHNAYER: Yes.

BY THE WITNESS:

A   The answer to that question is no.

BY MR. SCHNAYER:

Q   Did you ever discuss with anybody the
fact of whether that question had been discussed
at all at Williams?

MR. GOLDENBERG: I object to that question
for reasons previously stated and not being likely
to lead to admissible evidence.

BY MR. SCHNAYER:

Q. You may answer the question.

A. Our basic system was not changed since 1977, regardless of the patent. So I am not sure that the questions you are asking really bear on what I am here for. I am here to discuss how our present system works. Our system has not changed.

MR. SCHNAYER: That is not the question I asked.

Could we have the question back?

MR. GOLDENBERG: The witness has already answered the question. I guess I will permit it one more time, sir, and then we will find another topic or find something else to do.

(Question read by the reporter.)

MR. GOLDENBERG: If you can, answer that one yes or no.

BY THE WITNESS:

A. I think the answer is no as best I understand the question.

BY MR. SCHNAYER:

Q. Is there any time during the normal operation of Williams' pinball machine, particularly a Flash game, which contained the modifications of

the program where the scanning of the switch matrix

would continue until complete and then it would be

repeated, continue to do that?

MR. GOLDENBERG: Normal operation to

him, do you mean during the operation of the game?

BY MR. SCHNAYER:

Q.   What do you define as normal operation?

A.   There are, as I have mentioned before,

three backgrounds, the middle one being a change on

the first and this last one being the one that we

are currently using. That one, the last one, was

also used for Flash so I will answer the questions

using that background.

Q.   The last background, the Flash?

A.   As the basis for my answers. During the

normal course of operation of the game, when the

game is scanning switches, it scans switches every

two milliseconds. It does a complete switch scan

provided that no switches are read during this switch

scan. If any switch is read during the course of

the scan, the switch scan ceases from that point.

Q.   That is the case throughout the entire

normal operation of the game?

A.   That is correct. The only exception to

that would be the overall scanning of switches can be inhibited under software control, and is in fact inhibited on a number of occasions in Flash for various reasons.

Q.   What are those various reasons?

A.   As a way to debounce switches, the scanning is inhibited. When drop targets are reset, we inhibit the scanning of switches. When the ball goes into the out hole, the scanning of switches is inhibited. When coin switches are registered, the scanning of switches is inhibited. There are a number of other occasions where inhibiting or scan kill takes place.

Q.   When the drop targets are reset, how is the scanning of the switches inhibited?

A.   When the series switch at the bottom of the drop target is completed, and the background acts upon that particular switch, the scanning of switches is inhibited for a fixed period of time while the targets are being reset by the coils, which reset those targets. That is done to prevent reading the momentary switches on the way up.

Our drop targets have two types of switches: A momentary switch, which is read when

the target falls, and then a series switch which is

read when all the targets are fallen, and they are

all down, not just two out of the three or four out

of the five, but when all of them are down. So

when we reset the drop targets, we do not want to

reread the momentary switches and act upon them, so

we inhibit the scanning of switches.

Q.   Are the lamps multiplexed in the Disco

Fever?

A.   The lamps are organized in a matrix.

Q.   Are they multiplexed?

A.   If by multiplexed you mean they are

scanned sequentially in a matrix, then the answer

is yes. They are scanned one column after another.

Q.   Is that how you would define multiplexing?

A.   Yes.

Q.   Are the switches multiplexed? Detection

of switch closures?

A.   Detection is again done in the matrix

form.

Q.   Would you characterize that as being

multiplexed?

A.   No, I would not on the switches because

it is a common technique to organize switches in a

matrix and to read them in a matrix form.

Q   How would you define that? Reading of
the switches in a matrix form. Would you have a
definition for that?

A   Scanning switches.

Q   Referring back to DB-39 --

MR. GOLDENBERG: DB-39 or 40?

MR. SCHNAYER: DB-40, thank you.

BY MR. SCHNAYER:

Q   What is the function of PIA-2 on Page 5?

A   PIA-2 on Page 5 is used as the PIA that
the microprocessor accesses in order to read switches.
The column strobes are generated as the rows are
read via that PIA.

Q   And the column strobes, do the signals
which are used for the column strobes come from the
port PA-0 through PA-7?

A   No, the columns are PB-0 to PB-7. The
rows are PA-0 to PA-7.

Q   Where is the switch matrix shown for
this Disco Fever?

A   It is shown in two places. Some of the
switches are shown on Page 11, and they are identified
as 7SW -1, SW-2, SW-3, SW-4, SW-5, SW-6 and 7, and

that is the first column of the switch matrix. It

is identified there as Column 1 and Row 1 through 7.

This is in the cabinet wiring diagram, and then the

switch matrix on the playfield is on Page 13 in

the playfield switch wiring diagram.

Q.   That is Columns 2 through 5 and Rows 1

through 8?

A.   That is correct. In this particular

background, the columns 5 through 1 were the only

columns scanned. Columns 6, 7 and 8 are never

scanned in this particular game and that is a software

determined function in the foreground. They are not

used, they are not scanned.

Q.   Is there some particular sequence with

which signals appear on Lines PB-0 through PB-7 on

Page 5?

A.   Well for Disco Fever they would appear

with PB-4 and going to PB-3, PB-2, PB-1, PB-0.

Then they would be repeated PB-4, PB-3. However,

the interval between successive scans, between going

from PB-4 to PB-0 one time and going from PB-4 to

PB-0 the next time is, in fact, dependent on going

back through the executive loop and it is not a time --

something which is dependent on a fixed amount of time.

That time is variable.

Q   Is the time between the appearance of a strobe on successive columns approximately equal?

A   Only when there are no switches being read. If a switch appears, then the time is not the same between successive columns because that information is processed at that point.

Q   If a switch closure is not present, then will the signals that appear on the strobe lines be equal between successive strobe lines? The time period between the appearance of strobes on successive strobes be equal?

A   Not necessarily because they can be interrupted by the interrupt service routine at any point.

Q   Therefore, for this particular game, Disco Fever, if the strobes are being generated, the CPU is at that point in the program, which tells the CPU to generate the strobes for the switch matrix, and at some point an interrupt is generated by the interrupt signal, then the CPU would go off and service that interrupt signal and then return and complete the sequence of strobing?

A   That is correct.

Q   What type of signal appears on the lines
PB-0 through PB-4 to indicate that that is the column
which is being strobed?

A.   It would be a high signal which would
then be inverted by the inverters IC-8 and IC-7.

Q   And those are the ICs connected to the
outputs of PIA-2, is that correct?

A.   That is correct.

Q   What is the purpose of the resistors
and capacitors connected to the inverter?

A.   The resistors and capacitors serve to
establish -- well the one is a series resistor, which
serves to establish the amount of current that that
device will actually pass.

Q   Is that, for example C-37?

A.   C-37 -- where are we?

Q   The top strobe line?

A.   I am on the wrong one, I guess. These
are not strobes.

Q   Let's look at the bottom one. That
would be capacitor C-56 for that strobe line?

MR. GOLDENBERG: I think there is a
misunderstanding here. I thought the witness
referred to a resistor as a limiting device, not

a capacitor.

BY MR. SCHNAYER:

    Q   That would be resistor R-92?

    A.   No, it would be resistor 211.

    Q.   What was the function of R-92?

    A.   It is simply a pull-up resistor.

    Q.   What is the function of the capacitor
C-56?

    A.   The capacitor C-56 is there for noise
immunity, if I remember correctly.

    Q.   Now as the signal appears, for example
on Column 2 on Page 13 of the switch matrix, and a
switch closure would be present on switches 8SW9,
what type of signal would be transmitted to the
PIA-2?

    A.   That signal would be reinverted by
the inverters on Page 5, IC-5 or IC-15 and IC-16,
so we would in fact get a positive true signal
appearing at the PIA PA-0 through PA-7 lines. The
columns would be lows going from the PIA and they
would be -- the closed switch would be a high coming
back to the PIA.

    Q   What are the functions of the resistors
and capacitors connected to the input line, for

example, PA-0?

A.   Again, the 1-K resistor, R196 would be

a series limiting resistor. The capacitor would

be a noise or static immunity capacitor, bypass

capacitor, and the resistor, R-77, would be a pull-up

so that when the switch matrix -- so when nothing

was connected to the switch matrix, it would not

appear that there was an input there.

MR. GOLDENBERG: You are still referring

to the drawing on Page 5?

MR. SCHNAYER: Yes, thank you.

BY MR. SCHNAYER:

Q   When a switch closure is present and

a positive signal indicating that switch closure

occurs on one of the input ports of PIA-2, what

happens to that signal? How does the microprocessor

further process that signal?

A.   Okay, the microprocessor in scratch pad

RAM, as well as having a lamp matrix and a display

matrix contains a switch matrix, which consists of

8 by 8s, which each individual bit in those bites

represents the condition of the switch, whether it

is open or closed.

In addition to that, there is a

stuck switch matrix which is also 8 ~~bites~~ bytes *PHD* long, which represents the condition of the switch on the previous scan. In order for a switch to be a valid switch: i.e., a switch that the microprocessor will operate on, the switch must first make, it must be read for two successive scans, and then it must break. If it is only read for one scan, that is not considered to be a valid switch closure. If it is read for three or five or 20 successive scans, that would be considered a stuck switch.

When the switch is valid or stuck, it will be acted upon one time, and then will not be acted upon again until the switch is debounced in the software, and until the switch opens again in the hardware.

Q   Why, if a switch is only detected during a single scan, is it not considered a valid switch closure?

A   Because of the fact that this is electromechanical and ~~enjoys the~~ NOISY *PHD* environment, it is possible to induce false signals on the lines. For example, there is a problem with microprocessor based systems with regards to noise immunity when very large voltages are applied to the cabinetry

or to the components. So in order to avoid any

possible noise or even mechanical vibration, possibly

making the switch closure one time, the algorism [ALGORITHM]

was devised that it should be two successive

switch closures or two successive scans, and it

was felt that with that particular scheme that

that would minimize false switch reads.

Q   Is that called debounce?

A   No, there is debounce in addition to

that. But this is to be considered a valid switch.

So that for whatever reason, if a surge appeared

on a line for a short amount of time, that would not

be considered a switch closure because of the way in

which the scanning is done.

In the electromechanical switches

that are used, a switch will be closed for a number

of milliseconds typically, so that this requirement

is very easily not. [MET]

Q   Is that also a requirement that the

switches be read on two successive scans for the

Flash game, which contained the third programming

scheme we were discussing?

A   Yes, yes. That also employs the same

stuck switch or valid switch algorism. [ALGORITHM]

Q   Isn't it possible to miss a valid switch closure if another switch has been detected and the microprocessor does not -- strike that. Isn't it possible to miss a valid switch closure because the scan does not complete if a switch is detected?

A   Yes, that is possible. If a number of switches occur at the exact same instance in time, it is possible to miss the switches, depending on where they are in the matrix. However, we found that that is not typically a problem in the game because the switches are operated by a ball, which must travel a certain distance over a period of time, which is well above the requirements of simultaneous closures.

Q   When a switch closure has occurred and a signal has appeared upon a return line, and that signal appears upon the input port of PIA-2, into what type of device is that signal stored in PIA-2?

A   The information from the PIA rows is stored into the scratch pad RAM at locations which I have identified as the switch debounce matrix and the switch matrix.

Q   As those signals appear on the input port of PA-2, indicating a switch closure, is that automatically

read into the scratch pad RAM?

A.   It is transferred to it.

Q.   How is it transferred?

A.   By the microprocessor program.

Q.   Does the microprocessor poll certain ports of the PIA-2 to determine whether a switch closure is present at those ports?

A.   The A side of the PIA-2 is considered to be an input. It examines that input for any condition which results in a switch closure, and if that information is present or even if it is not present, it stores that fact, what is read, into the scratch pad memory.

Q.   Does it examine all of the input ports of PIA-2 at the same time?

A.   Yes, they are read simultaneously. All eight rows are read at one time.

Q.   Then is a data signal representative of whether switch closure signals are present on those input ports, transmitted to the memory location of the scratch pad RAM?

A.   I do not understand what you mean by transmitted. The information is read and it is

stored. It is as simple as that. The microprocessor reads this location. It is a memory location, as far as the microprocessor is concerned, and it transfers that information into another location. It is very straightforward.

Q   If there are two switch closures at the same time present when a column is strobed, does the microprocessor read those switch closures at the same time and transfer that information back to the scratch pad memory at the same time?

A   Yes, it reads all eight rows simultaneously and transfers all eight rows together into the new location. So effectively you could think of our scanning as reading eight switches at a time.

Q   Is the strobing and the reading of the inputs from the switch matrix done in a similar fashion for the Flash game containing the third modification to the program?

MR. GOLDENBERG: To the background program.

BY THE WITNESS:

A   No, it is not. In the Flash or the third background, all the switches, all the columns are scanned whether or not switches are present, if no switches are read. If a switch is read, the

scanning ceases from that point.

BY MR. SCHNAYER:

Q.   And that is the only difference?

A.   And the fact is that switches are only

scanned as a result of interrupts, which is a major

difference.

Q.   During the operation of the game, is

there a time when the portion of the scratch pad

memory representative of the state of the switches

is interrogated?

A.   No.

Q.   If it is not interrogated, how is the

switch closure used to perform the various functions

indicated of a switch closure?

A.   When a switch closure is recognized and

is considered to be a valid switch, then that switch

number is put into a set of counters which are also

in the scratch pad RAM. The microprocessor as part

of the executive loop, ~~modifies~~ MONITORS (pub) the condition of the

~~monitor~~ COUNTERS (pub) to see if anything has been inserted into

those counters. When something is inserted into

those counters, it will then go to the foreground

and calculate what is necessary for it to determine

where to go to handle that particular switch. ·Then

it will start the debouncing of that particular switch.

That switch will not be acted upon again until it has been removed from the counters, even though it can be read again as a valid switch a number of times.

MR. SCHNAYER: Would you read back his answer?

(Answer read by the reporter.)

MR. GOLDENBERG: Mr. Schnayer, I do not think the witness should have to sit here, nor should I have to sit here for that matter while we go through that kind of exercise again. I appreciate your right to take notes and take time to frame questions, but to literally transcribe the testimony of a witness is out of order and a shameful waste of our time.

BY MR. SCHNAYER:

Q.   What specifically are the purposes of the counters?

A.   The counters are used to debounce the switch and to indicate whether or not the switch has been acted upon.

Q.   Does the microprocessor interrogate the counter to determine whether a switch closure

has occurred?

A   It looks at the switch counters to see if there is something present and whether or not that switch has been acted upon. If it has been acted upon it does not act on it again.

Q   Is there some place in the memory to store the fact of multiple switch closures?

A   Yes.

Q   Where is that?

A   That is also associated with these counters.

Q   How is the fact of multiple switch closures indicated in the counters?

A   That depends on which background you want to talk about.

Q   When you say which background, what do you mean by that?

A   I mean do you want to talk about Disco Fever or do you want to talk about Flash, because they were handled in different ways.

Q   Let's talk about Disco Fever first.

A   In Disco Fever there were four counters.

Q   Why were there four counters?

A   To allow for two switches to be in the

process or three switches to be in the process of

being debounced and a fourth switch to be read and

processed accurately. To allow for acting upon more

than one switch every debounce number of times.

If there was only one counter, you

would have to wait until the switch was completely

debounced before you could put another switch in its

place, which would make for a very slow reading

switch system.

Q. So you can only handle four switch

closures at any one time?

A. Simultaneously.

Q. And there is no provision in the system

to store more than four switch closures?

A. That is correct.

Q. How is that different in the games after

the Flash?

A. In addition to the four switch counters,

there is a three-element stack, which allows us to

have three additional switches waiting to be put

into the switch counters, so we can have actually

seven switches that are waiting to be timed out or

waiting to be acted upon.

Q. Does each switch have a particular number

representative of that switch that would indicate

that is the switch where a switch closure has occurred?

A.   Each switch has a position in the matrix,

and that position in the matrix allows us to deter-

mine which switch has been closed.

Associated with that, you could

naturally assign a number. You could say it was

Switch 22. In fact, Switch 22 was in Column 3, the

fifth switch down, whatever. The sixth switch down.

Q.   Why were the additional three-element

stacks added to the Flash game?

A.   So there was never a possibility of

missing switches.

Q.   Did you find that the four counters were

not adequate for the previous games?

A.   The four counters are adequate in some

games and they are not in others. It depends on

which particular types of playfield components are

installed on a game. In fact, that is a very

difficult issue to resolve as to whether or not

any switches were missed. I do not think any switches

were missed with four counters. With seven I would

guarantee or venture to say that my confidence in-

creased by 95 percent to 99 percent on reading all

switch closures.

MR. SCHNAYER: I would like to take a five or ten minute break.

MR. GOLDENBERG: Surely.

(There was a recess taken.)

BY MR. SCHNAYER:

Q. What is the function of PIA-4 on Page 6 of BD-40?

A. PIA-4 is the interface between the microprocessor and the solenoids.

Q. Where are those solenoids shown in this group of schematics, BD-40?

A. Two of the solenoids are shown on Page 11.

Q. Those are what solenoids?

A. 7L14 and 7L16.

Q. Could you point those out?

A. Right up here.

MR. GOLDENBERG: In the upper right-hand corner.

BY THE WITNESS:

A. (Continuing) And the other remaining solenoids are on Page 12 in the section identified as playfield solenoids wiring diagram.

BY MR. SCHNAYER:

Q. Are the solenoids directly driven?

A. They are driven through the PIA and the drive transistors and directly energized, if that is what your question meant.

Q. Yes. Could you explain what type of signal is necessary from PIA-4 to activate the solenoid represented by the Solenoid 1 drive?

A. In order to energize Solenoid 1, Line PA-0 of PIA-4 must be brought to a logic level high, and blanking must be present in order to turn on the predriver transistor, which will in turn turn on the Darlington transistor, which will supply a ground for that particular solenoid.

Q. So each of the solenoids is connected to a high, is that correct?

A. Yes, each solenoid is tied to the solenoid B-plus voltage.

Q. When it is actuated, it is connected to the ground through the various drive transistors?

A. Right, the PIA energizes a ground for that particular solenoid.

Q. Is there any difference in the operation of the solenoid shown on the left side of Page 6

and the solenoid shown on the right side of Page 6?

A.   Yes, there is.

Q.   What is that difference?

A.   The difference is that the microprocessor directly controls the solenoid identified as Solenoid 1 to 16. Again the microprocessor may energize those and de-energize them whenever it is necessary. The six solenoids on the right-hand side are what are referred to as special solenoids in our system, and those solenoids are operated by switches which are on the playfield. They are enabled by the micro-processor, they can be driven by the microprocessor during diagnostics for testing purposes, but during normal game play they only operate as a result cf a switch on the playfield being closed, which energizes a driver transistor, which in turn supplies the ground for that particular solenoid. Blanking also is part of this circuit.

Q.   Is there any time when all those solenoids, the special solenoids, can be prevented from being actuated?

A.   Yes, there is, during game over or when the game is tilted, those six solenoids can be disabled or enabled as a group.

Dussault - direct

Q   How is that done?

A   That is done via a control line on PIA No. 4, which is shown as CB-2. That line will also enable or disable flippers.

(There was a brief interruption.)

BY MR. SCHNAYER:

Q   The solenoids are actuated for a certain period of time, is that correct?

A   That is correct.

Q   What period of time is that generally?

A   For the most part it is dependent upon the particular device that the solenoid is meant to actuate, but anywhere from 64 milliseconds to 96 milliseconds or 128 milliseconds. Sometimes it is as short as 32 or 16 milliseconds. Sometimes the solenoids are held on, they are energized on and left on, and that is also another instance. Other times they are pulsed.

Q   Is there a particular reason to pulse them for a certain period of time?

A   Mainly because of the fact that that is all they need to be operated, and because of the amount of power that they draw, they can only be operated on an intermittent duty, they cannot be

operated continuously. Otherwise our fuses would

blow.

Q   Is that generally called a solenoid on

time? Do you know what solenoid on time means?

A.   It is the time that the solenoid would

be held energized.

Q   How does the microprocessor determine

the period of time has occurred for the solenoid to

turn off?

A.   It uses the scratch pad RAM, which is

decremented every time an interrupt occurs or

every time a certain interrupt occurs, and when

that counter goes to a certain value, which could

be zero or a fixed value, then the solenoid is then

turned off. The different backgrounds implement that

in a different way.

Q   So in other words, as the solenoid is

actuated, a certain number is stored in that particular

memory of scratch pad representative of that solenoid,

and every time an interrupt occurs, that number is

reduced until it reaches a certain level, which

indicates that it is time for the solenoid to be

turned off?

A.   That is correct.

Q.   How does the microprocessor know that
that time has been reached when the value in the
scratch pad memory has reached a level to indicate
that the circuit should be turned off?

A.   Because it has a value that it is
comparing it to. When that count reaches that value,
then the time is up, and it will remove it from the
on matrix or from the on solenoid.

Q.   So every time it reduces the value, it
then checks the value to see if it has reached that
lower level?

A.   That is correct.

Q.   If it has, it generates a signal to tell
the microprocessor, is that correct?

A.   The microprocessor is what is doing it,
so it knows what it is doing. When it detects the
fact that that particular condition is true, it
will then go about the process necessary to turn the
solenoid off, or remove it from the PIA.

Q.   Is that the same procedure that is
followed for the Flash game in order to actuate and
turn off solenoids? By Flash game I mean the games
after Flash which contain the program change.

A.   Conceptually they are very similar. The

amount of time is different in the Flash or the

latest background. The solenoid can be or the PIA

for the solenoid can be operated in one of two modes.

(Brief interruption.)

MR. SCHNAYER: Would you read back the

last question and its answer?

(Record read by the reporter.)

BY MR. SCHNAYER:

Q   When you say it can be operated in one

of two modes, what do you mean?

A   By two modes I mean that that PIA can

be actually used to drive solenoids which are

physical solenoids or it can be used to pass infor-

mation via the solenoid location to a sound board.

When it passes the information to the solenoids, it

will either turn the solenoids on or energize it in

32 milliseconds and increment from 32 milliseconds

up to 224 milliseconds. Otherwise when it operates

in the other mode to transmit signals to the sound

board, it will operate very much in a -- I want to

use the word binary fashion, but the gist of it is

that it will put a signal out there for a very short

period of time and then remove it from the solenoid

box. That signal is sufficient to signal the sound

Dussault - direct

board to make it operate.

Q.   So PIA-4 on the Flash game is used for the generation of sound, signals for the generation of sound, is that correct?

A.   It is used to energize coils and it is used to convey information to the sound board which has its own intelligence, and own processor.

Q.   It has a separate processor?

A.   Yes.

Q.   Is there a provision in the Disco Fever for generating sound?

A.   There is a sound board in Disco Fever, which is shown on Page 15 of the schematics which has its own microprocessor. Its own intelligence. That sound board is connected via the lines identified as sound select input which are tied to the lines coming off of the solenoids.

Q.   Which lines are they on Page 6?

A.   It is referring to Page 11. Lines for Solenoid 9, 10, 11, 12, 14 and 15, and in some cases 13 rather than 15.

Q.   Are those common lines that are used to drive solenoids?

A.   Yes, those lines can either drive

solenoids, but in this case they have been assigned
to drive the sound board.

Q   So the difference in the two systems
is that the same lines are used to drive the sound
board as are used to drive solenoids for the Flash
system; whereas, in the systems before Flash,
separate lines were used to drive -- no, the same
lines are used also.

Q   What is the difference in the two
systems?

A.   The difference is in the time that the
information is passed to the sound board, the
amount of time, and also in what form that infor-
mation is passed.

        In the Disco Fever only one of
those six particular lines would be active at any
given time. In the Flash and subsequent games,
any one of five or two or three or four, or all
five of five lines can be active at any given time.
So they have been encoded to provided a dual purpose.

Q   Now I believe you testified that with
the Flash game there were two changes made to the
program.

A.   That is correct.

Q.   One of those was a minor change and one
was a major change or more major change.

A.   The original Flash game introduced our
second background, which was identified as a 5A9196
and a 5A9197. Those were the part numbers for that
background.

Q.   You call that --

A.   That is the second background or the
Flash background, if you want to think of it that
way. Flash was the first game to use that background.
Prior to the end of production of Flash, the 9233
background had already been completed and had been
tested in another game, and because of a supply
problem on ROMs, Flash was redone in the 9233-34
background and worked essentially identically to
the player. Internally there were significant
changes, but externally you could not tell the
difference between the two games. I can tell the
difference because I know that there are very
subtle differences between the two, but to a layman
having one with one background here and the other
with the other background there, they would play
identically.

Q.   Why was the second background done in

the first place, the second background change?

A.   The first background was changed in order to give us more power and more flexibility than was available in the first background.

Q.   Why was the next change made?

A.   The next change was done to correct some of the problems which had been found in the second background and to further simplify the foreground of those games for that new background. Some things that were being done in the foreground were put back into the background so that it was not necessary to program every foreground to do those functions.

Q.   What type of functions were those?

A.   For example, at the start of a ball, to raise drop targets. A particular game might have two, or three, or four drop targets that needed to be raised at the beginning of each ball.

In the Flash background, it took a special subroutine in the foreground in order to do that. The newer background allowed that to occur as an automatic function of the background, so that a special routine did not have to be written every time a solenoid drop target needed

to be reset.

Now in addition to that, there is
also a change, as far as our hardware at the time.
That was when the dash six was introduced, and in
order to take advantage of a particular feature
of the dash six CPU board, several other changes
were made to the new background. That pertains to
what is called the memory protection feature.

Q   What was the memory protection feature?

A   In the dash six CPU board, what was done
is, in our system we have game adjusts and we have
bookkeeping. That information is retained in a
CMOS RAM which is a battery backed up RAM. When
the power is turned off, the information is retained
in the CMOS RAM and then when the power is reinitialized,
the program checks to see whether or not the information
is still correct or still valid. If it is, it will
then go ahead and start the game. If it is not, it
will restore some factory settings, and it will
indicate that to the operator, that it has done that,
that the machine has gone back to the factory settings.

In the dash six CPU board, we added
some hardware circuitry to make the section of
memory where the game adjusts reside the memory

protected so that the microprocessor could only write to that section of memory in a very specific time. That was when the coin door was opened. It was actually circuitry which inhibited writing to that upper half of the CMOS while the coin door was shut. It was done in that manner so that if for whatever reason the microprocessor would fail or would act in a way that it was not supposed to, it would not alter the factory settings, or the settings which had been changed by the opertor for his particular location. That area was memory protected. So going from the 9196 to the 9233-34 background, there were some things that were reshuffled to allow for this partition.

Q   Did you have any experience prior to your working at Williams with pinball machines?

A.   I played them when I was a kid.

Q   Did you have any experience with servicing pinball machines?

A.   No.

Q   Did you ever take one apart prior to your working at Williams?

A.   No.

Q   Did you work with anybody from Williams

when you worked for Addressograph Multigraph? In

other words, when you worked for Williams, who

else worked with you when you worked for Williams?

A.   I worked with Ron Crouse when he was at

Addressograph Multigraph.

Q.   Under what circumstances did you first

learn that a job was available at Williams?

A.   Ron told me.

Q.   While at Williams, did you ever have the

occasion to examine competitor's games?

        MR. GOLDENBERG: You are talking about

pinball games now?

BY MR. SCHNAYER:

    Q.   Pinball games?

    A.   In which period of time?

    Q.   Any period of time.

    A.   Yes.

    Q.   What games did you examine?

    A.   I have seen a home Fireball, I have seen

some Gottlieb machines, I have seen some wide-body

machines, I have seen some European machines.

        By examine, I would have to qualify

that to say that I have opened the machines and

looked inside them. I have not disassembled the

software or particularly been inclined to do anything

else other than look at the placement of the PC

boards or how the cabling was done or what types

of solenoids were used, how things were positioned.

That is the only interest I have had in foreign or

competitive machines.

Q. Have you ever seen any games produced

by Bally beside the Fireball?

A. I have seen Paragon.

Q. Have you ever seen a game called

Night Rider?

A. I have played Night Rider at arcades

but I have never looked inside a Night Rider.

Q. To your knowledge has Night Rider ever

been present at Williams Electronics?

A. Not that I recall.

Q. Under what circumstances did you examine

the home Fireball?

A. I removed the glass and I raised the

playfield, and I looked at the playfield by using

integrated circuit on the bottom of the playfield.

It is a large PC board which is what interested me.

Q. Why were you looking at the game?

A. Because we had at one time thought

of doing that type of technology. We made a large

scale printed circuit board. It did not turn

out to be very practical in our opinion, or in my

opinion.

Q. Do you remember what period of time you

looked at the Fireball?

A. No, I do not recall.

Q Was it close to the time you became

employed with Williams?

A. It was some time after I came to Williams.

I do not recall where I saw the Fireball. I think

it was when we finally moved to California Street.

Q. When was the move to California Street,

do you know?

A. I do not recall the exact date.

Q. Approximately?

A. I think February of '78, in that area,

I think. February or March.

Q When you say you thought at one time of

using the type of technology used in the Fireball,

that was specifically with regard to the type of

board used?

A. Specifically using an integrated circuit

or a large scale printed circuit board for the

underside of the playfield. That is what I looked

at it as. I was amazed to find when I looked at

the Fireball that that had been done. I had never

seen a printed circuit board of that size before.

Q   Did you discuss the Fireball with anybody?

A.   We discussed that that was not a very

practical approach for our particular system and

that is as far as it went.

Q   Did you ever discuss the fact of whether

Fireball had been looked at before by anybody?

A.   Not that I recall.

Q   Do you ever remember any discussions

regarding Bally pinball machines other than the

Fireball?

A.   The only discussions I recall were that

Bally had already introduced a solid state pinball

machine when I was applying for the job at Williams,

but that we had designed -- or Williams had designed

their own and that they were about to introduce it.

That was about the only context that I remember

talking about Bally pinball machines.

Q   Is any work being done at Williams to

design a -- to do any design changes to the micro-

processor controlled pinball machines Williams

produces?

MR. GOLDENBERG: I object to the question

and advise the witness he need not answer.

(There was a discussion held

off the record after which

the following further proceedings

were had herein:)

MR. GOLDENBERG: I advise the witness he

need not answer.

BY MR. SCHNAYER:

Q Do you have any understanding as to

whether there are any plans at this time to intro-

duce a pinball machine at Williams containing a

control circuit having a different design than what

is presently contained in the pinball machines?

MR. GOLDENBERG: I object to that question

and advise the witness not to answer. I should think

my reasons are obvious but I should state that I must

go to the previous objection also. I cannot imagine

anything more remote to the issues in this case

whether the Bally patent is valid and infringed than

that kind of question. You have no right to go into

Williams pre-design activities or plans for future

products, sir. You know that.

MR. SCHNAYER: If there is an intention to introduce a new product, which is designed differently from the old product, then that most certainly is a relevant issue to the case as to whether that new product infringes the patent.

MR. GOLDENBERG: If and when Williams brings out a new product, you deal with it then, and not until.

MR. SCHNAYER: I do not know if Williams intends to because the witness has not been allowed to answer the question.

MR. GOLDENBERG: Their intentions, sir, have nothing to do with it. If and when they do then we will deal with it.

BY MR. SCHNAYER:

Q. Have any pinball machines been put in the field for tests containing design changes to the solid state control circuit that is being included in the pinball machines that have been manufactured by Williams in the past?

MR. GOLDENBERG: Let me understand the question. You want to know if Williams is presently field testing any pinball machines in which there has been circuit design changes over those that you

previously have gotten evidence about?

MR. SCHNAYER: Yes.

MR. GOLDENBERG: I will permit that
question to be answered.

BY THE WITNESS:

A.   The answer is no.

BY MR. SCHNAYER:

Q   I show you a copy of documents that have
been produced in this litigation W-8, labelled as
Production No. W-8, several pages stapled together,
and ask if you recognize that to be something you
have seen before or a copy of something you have
seen before?

A.   This looks like the schematics for the
Bally system.

MR. GOLDENBERG: The question was have
you ever seen them before.

THE WITNESS: I have seen the schematics
of the Bally system before, yes. So if these are
copies of that system as such, then I have seen
these. Are these copies of the existing Bally system?

BY MR. SCHNAYER:

Q   I do not have the originals. They
are what they are.

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THE WITNESS: I have seen whatever they
give with every machine, service manual and schematic
manual that they give with every machine. I have
seen that before.

BY MR. SCHNAYER:

Q I show you a copy of a document produced
by counsel in this litigation with Production Nos.
W-85 through W-167 and ask if you recognize that
to be a copy of something you have seen before.
I guess that is W-168.

A Now you're asking me if I have seen
this --

Q If you recognize that to be a copy of
something you have seen before?

A I have seen this manual. This is the
Bally Component Level Repair Manual. I do not know
if I have seen this particular revision, but I have
seen the Bally Component Repair Manual.

Q Under what circumstances did you see
that Bally manual that you did see?

A When I first came to Williams, my job
was to write service manuals and I looked at Bally's
manual to see how they were presenting that
information.

Q.   So there was a manual that was already present at Williams when you got there?

A.   There was a game plan manual and schematics.

Q   Are those copies of the schematics?

A.   I do not know if these are the schematics. I looked at them to see what their format was, and then I came up with the format which was used in these schematics.

Q   Did you ever discuss with anybody how the schematics were obtained, how the manual was obtained that you saw?

A.   No, I did not have any interest.

Q   I show you copies of documents produced by your counsel in this litigation with Production Nos. W-9 through W-84. The front page of W-9 appears to have the heading "Game Number 1066-E Freedom, Installation and General Game Operation Instruction Index", and I ask if you recognize those to be copies of something you have seen before?

A.   This seems to consist of two parts.

MR. GOLDENBERG: The question is have you seen it before?

THE WITNESS: What he has just asked me about here is exactly what he has presented to

me before. That, in fact, is the exact same thing
that he presented me before. That, in fact, is the
exact same thing that you just asked me with other
numbers, I believe. Is it not?

MR. SCHNAYER: It looks a little
different. One is November. It seems to be similar
but not the same.

BY MR. SCHNAYER:

Q   Let's restrict it to -- here are some
Freedom documents here. It appears that these are
mixed up. Do you recognize any portions of those
to be copies of something you have seen before?

By those I mean W-9 through W-37.

A   I do not think I have ever seen the
schematics for Freedom because I would remember
the word Freedom. I do not recall seeing this
particular set for the game identified as Freedom.

Q   Have you seen some set for the game
Freedom?

A   No, I do not recall seeing a set for
Freedom.

Q   Have you seen any documentation for
the Freedom game?

A   Not that I am aware of. I have seen

the general schematic which, if Freedom contains the

same system, I guess by default I have seen the

schematics, but specifically for Freedom --

MR. SCHNAYER: Let's take about a five

or ten minute break. We are approaching the end of

this and we will probably finish today. Why don't

we take a few minute break.

MR. GOLDENBERG: I would be pleased and

delighted and of course.

(There was a brief recess after

which the following further

proceedings were had herein:)

BY MR. SCHNAYER:

Q   Are you familiar with the operation of

Shuffle Alley? I am interested in finding out if

he would be the witness, if we ultimately have to

call somebody with regard to those questions,

whether he would be the appropriate person to call.

A   Yes, I am.

Q   Are you familiar with the software

programming?

A.   Yes.

Q   Do you have any belief as to whether you

were the person most qualified to answer questions

about the operation of Shuffle Alley games at

Williams, specifically with regard to software

equipment?

    A.   At this time I am.

    Q.   I show you a copy of a document which

has been produced by counsel in this litigation.

I do not believe it has a production number on there.

It appears to be a set of Flash schematics, and a

Flash solid state manual.

            We received copies of several

manuals without numbers on them. We could mark

these -- let's do that with production numbers.

            MR. GOLDENBERG: Do you know the last

number that you have, Jerry? I do not offhand.

            MR. SCHNAYER: Why don't we mark them

as a BD number. I will do that and then we can add

the numbers later on. BD-100 and BD-101.

                (Exhibits BD-100 and BD-101

                marked for identification.)

BY MR. SCHNAYER:

    Q.   I show you what has been marked BD-101

and ask you if you recognize that to be a copy of

something you have seen before?

A.   Yes, I have SEEN [crossed out: the] the schematics before.

Q.   What do you recognize those to be?

A.   These are the schematics which were
included with some of the Flash games.

Q.   Which Flash games would those be?

A.   This schematic is the schematic of a
dash four CPU board, which would indicate that it
would only be the early Flash games, or the initial
production of Flash games. The end of the run of
Flash games had dash six CPU boards, and the new
software, so this group of schematics does not
reflect that additional board. In fact, I believe
the schematics were revised after January to add
that second board in here.

Q.   So therefore, those do not show any of
the changes?

A.   They only show the dash four CPU board,
not the dash six CPU board.

Q.   Would that be with regard to the first
change of the software or second change?

A.   First and second. These show the first
change. There should be another set which is
probably dated March or something like that, or
April, or May. When we actually went into the other.

Q   I show you a copy of BD-100 and ask you if

you recognize that to be a copy of something you have

seen before?

A   Again this is a manual which is the

Flash manual, which is of the early version. We

did make some games with the alternate background,

and this does not reflect that particular condition.

There are some added sheets that were made as as

addendum, which showed the dash six board rather than

the dash four CPU board, and which showed the new

adjustments and bookkeeping settings, as opposed to

the ones from the original Flash. The order of

things changed a little bit again to take that memory

protect feature, take advantage of that memory

protect feature so you have got some of it but not

all of it.

          MR. SCHNAYER: I would again make a

request at this time that we receive copies of

both schematics and the manual for games for the

provision of Flash and for the games past Flash.

          MR. GOLDENBERG: While we are on that,

that would include Flash, Tri-Zone, Time Warp and

Gorgar. Do you have Contact and Pokerino?

          MR. SCHNAYER: I do not believe we have --

let's see. I know we do not have Stellar Wars and

Laser Beam. I'm not sure if we have Contact or

Pokerino.

MR. GOLDENBERG: Why don't we do this.

Could you get copies of those instruction books or

service manuals and schematics and send them to me?

THE WITNESS: Yes.

MR. GOLDENBERG: That would include the

modified forms of Flash also.

THE WITNESS: I will try to find those.

You know there have been changes as we have gone

along, like a prototype might be built one way and

a production may be built another way. I do not

know if I could find documentation for the proto-

type versus production.

MR. GOLDENBERG: We will just go ahead

and get the production version.

THE WITNESS: Do you understand what I

am saying?

MR. SCHNAYER: I understand what you are

saying.

THE WITNESS: Sometimes when a prototype

is out, the manual was in fact not ready for the

start of prototype, so they will put a number of

change sheets, and then they will put the manual in.

MR. GOLDENBERG: We will just deal with production.

BY MR. SCHNAYER:

Q   By examining the documents in BD-101, could you point out the differences in the component structure of the system?

MR. GOLDENBERG: Wouldn't it be perhaps helpful if we had a frame of reference?

BY MR. SCHNAYER:

Q   Differences with respect to the Disco Fever?

A   This is the same schematic that you have in Disco Fever. It has just been redrawn. There are several revisions, Page 3 of this document.

Q   That is the same as Page what in the Disco Fever manual?

A   It is the same as Page 3 in that manual.

MR. GOLDENBERG: Page 3 of BD-101 is the same as Page 3 --

THE WITNESS: Right, what are the numbers on the lower right-hand side.

MR. SCHNAYER: 7998.

THE WITNESS: Right, which is this document

redrawn.

BY MR. SCHNAYER:

Q   So there was no hardware change?

A   For example, they did make a couple of minor changes where they deleted a capacitor and added a resistor. They added a diode. They moved or did some revisions to the pin numbers on one of the ICs.

MR. GOLDENBERG: The witness is pointing to the upper left-hand corner where there is a list of revisions which appear.

MR. SCHNAYER: That is not contained on Page 3 of BD-4.

THE WITNESS: The revision block would be here, which is the lower left corner of Page 3 of DB-40.

MR. SCHNAYER: That has provisions A through E and ICU has provisions F through H.

BY THE WITNESS:

A   Again this is what is referred to as the dash four board, commonly referred to as the dash four board.

BY MR. SCHNAYER:

Q   Is that dash four designated some place?

A.   It is designated on the PC board itself. It says dash four, so you do not have --

Q.   That is on Page 2?

A.   Right.

Q.   BD-101.

A.   That is a dash two or dash three board because it does not show the extra socket, and these components have been drawn in as an after or an add on. In this version those changes were made part of the PC board artwork and incorporated on the PC board rather than to have to be manually soldered on or piggy-backed on to a particular part.

Q.   You have mentioned the fact that CPU changes revisions 2 and 3, is that right?

A.   Yes.

Q.   Then the fourth one, which is shown on BD-101, Page 2 --

A.   That is correct.

Q.   What was the purpose of the revisions for CPU 2 and 3?

A.   The difference between CPU 2 and 3 as I recall was to add this particular socket, which is identified as IC-26. It was to give us one additional PROM socket on the board.

Q   So that you could add a PROM if you needed to?

A.   So we could put a larger foreground program in that particular board. That was necessary for World Cup prototypes. They had three PROMs. What was done there was the socket for IC-14 was cut and jumpered to make it into a PROM socket, as opposed to a ROM socket.

For production, the background ROM was changed so that that was not necessary, but at the same time we also revised the board to allow for the third PROM so that if they wanted to put the new board in an old game they would not have to make the cuts and jumps, they could just stick it in that socket. Subsequent games have sometimes used the third PROM location. Other times they have not, depending upon the particular game.

Q   What was the purpose of CPU-2 versus CPU-1?

A.   I do not think -- I think CPU-1 was the very first version and I do not think it was ever built production-wise. CPU-2 was the very first production version.

Q   That is shown in BD-40, Page 2?

A.   Yes. Again the hardware people would

know a little bit more of the history of that as far

as the date specifically and what changes, what

individual specific changes took place from 2 to

3 to 4 and there were again modifications made along

the way so the four may have been modified.

Most of the modifications were in

the CMOS memory area, and one of them was in the

clock chip area. Motorola specified a fix for their

clock chip, which we incorporated, and because of

our -- we were experiencing memory failures or what

appeared to be memory failures in the CMOS area, we

redid the circuitry and made changes and that did

not take care of all of our problems, so that is why

we went from the dash four circuitry to the dash six

circuitry with a memory protection added, so that

that would even eliminate more of the possibilities

of the microprocessor crashing that memory or

inadvertently obliterating that memory.

Q.   Were there, referring to the other

boards, I believe there are three boards in this

system?

A.   There are actually five boards in our

system, six types of boards in a system.

Q. What types of boards are those?

A. The CPU board is the major board. The driver board is the second board. The power supply is the third board. The master display board is the fourth board. The slave display board is the fifth board, and the sound board is the sixth board.

Q. Which board, which schematic shows the driver board?

A. The driver board is shown on Pages 4 and 5 of BD-101.

MR. GOLDENBERG: Which of course is what the document says.

BY MR. SCHNAYER:

Q. What changes of physical components were made from the Disco Fever to this particular revision of the Flash game?

A. Okay. The changes that I recall are on the resistors that are on the switch matrix columns, the series resistor was changed from 1-K to 330-K or 330 ohms, I am sorry.

Q. What was the reason for that?

A. The reason for that was to give us additional driver capabilities so we could handle three switches which were closed in the same column

simultaneously, and read another switch reliably.

That was a problem with having a 1000 ohm resistor.

Q   You could not read three switches

simultaneously in one column?

A.   That were closed simultaneously. There

was not enough drive current to do it, so that was

a hardware fix to eliminate that problem.

Q   Were there any other changes that were

made?

A.   There is a revision block here which

shows the other changes which were made.

Q   This revision block on Page 5 of BD-40

contains provisions A, B and C.

A.   This one contains A, B, C and D.

Q   The third one would have been D?

A.   Right.

Q   That relates to the resistor change?

A.   Resistor change, right.

Q   Which schematic shows the master slave

board on BD-101?

A.   The master is on Pages 8 and 9. There

have been a variety of versions of the master display

board, depending upon the particular components that

were available from given suppliers, but they are

interchangeable, and in fact there is another version
of this board, which is made up of discreet transistors
and resistors and capacitors as opposed to integrated
circuit devices.

Q   That has been actually used in games?

A.   Yes.

Q   Does it use the same technique to operate?

A.   It is the functional equivalent. You
take this board out and plug the other board in,
it works identically. The same board. It is just
instead of using an integrated circuit, they used
a number of transistors which are, in fact, incor-
porated in that integrated circuit. They actually
put the little transistors on the board, and that
was because we were not able to get parts from our
suppliers, and depending on whether we use a part
from one supplier or another supplier, resistors or
a diode may be added or removed or changed. But
basically they all function the same way.

Q   Which diagram shows the master slave
board on BD-101?

A.   The slave board is identified on Page
10. It just consists of a 7-segment, 6-digit display
mounted to a PC board with a couple jumpers. That

is all that is on the board. There is nothing else

on it, and the schematic is just below it.

Q When the IRQ service routine is called

by the microprocessor after the occurrence of an

interrupt signal, we discussed three things which

were done: The strobe information was updated,

the display lamp information was updated, and the

decrement counter was acted upon, is that correct?

A That is correct, for the Disco Fever

background. Those were the principle things that

were done during the interrupt service routine.

Q Now when we talked about the decrement

counters being acted upon, what is the function of

those counters in Disco Fever?

A Those counters are used to either turn

off solenoids or debounce switches.

Q We previously discussed how the

solenoids were turned off. A number was loaded onto

a counter and then it was reduced everytime the

interrupt occurred, is that correct?

A I heard the question, I am looking to

see if it is done on every interrupt or every 16

interrupts specifically. My sense is that it is

done every 16 interrupts. It is every 16 milliseconds

it would decrement, and the count would be in 16 milliseconds.

Q   It would examine the value in the counter to determine whether it had reached a value to indicate that the solenoid should be turned off?

A   That is correct.

Q   When you say those decrement counters are used for debouncing switches, what do you mean by that?

A   Again the switches are handled. They are software debounced. The software when it recognizes a valid switch, puts that switch into a counter. When that switch is acted upon, that is indicated in that counter and a debounce time is put into the counter. That switch will not be acted upon again until the debounce time is over.

Q   When the debounce time is over, it will read the switch again?

A   It can read the switch again, and act on it. In the meantime, it could read the switch, but because the switch was in the process of being debounced, it would not act upon it again. It would ignore it.

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Q   What is that debounce time?

A.   It is different for the two backgrounds.

Q   When you say it is different for the two backgrounds, you mean for the background for Disco Fever?

A.   For Disco Fever it would be a number -- I will have to look at that to give you the exact count. It would be 15 milliseconds. For the Flash or the newest background, it would be 32 milliseconds.

Q   What is the purpose of debouncing a switch closure?

A.   The switches, because they are mechanical in nature, tend to in fact when they are closed, vibrate a great deal. Those vibrations could be misinterpreted by the microprocessor as repeated closures. The purpose of debounce is to let the switch settle down after it has been recognized as a switch closure before acting upon it again so that we do not act on one closure a number of times because of vibrations in the mechanical devices. That is why debounce is used.

Q   So it is put into the counters for a certain period of time, and during that period of

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time it disables the circuit from reading or detecting other switch closures.

A. No, during that period of time, that particular switch will not be processed again, and will not be put back into the counters to be processed again. It will be ignored, just that one switch.

Q. And that could lead to possible mixing switch closures?

A. If it was the same switch closing a thousand times a second, yes. If it was the same switch operating two times a second, no. It would have been debounced by then.

Q. Debounced by that time.

A. That is why it was put there. It is very difficult mechanically to operate a switch more than once a second legitimately on the playfield.

Q. Now with regard to the IRQ service routine and the games after Flash, besides performing those three functions, the updating the strobe information, updating the display lamp information and acting upon the decrement counters, what other functions does the service routine perform?

A.   It scans switches.

Q.   Which we discussed previously.

A.   Which we discussed. It keeps track of
the actual time the ball has been in play and works
on counters for that. It works on other counters
for the cyclers of which we can have four independent
cyclers operating. It will also look to see whether
or not solenoids have been timed out and if so, in-
dicate that so that when we return to the executive
loop, they will be removed from the solenoid PIA.
So virtually all the timing in the game is done
as a result of the IRQ in the new background.

Q.   Weren't the solenoids, the detection
of the timing out of the solenoids also done in
a similar fashion for the Disco Fever?

A.   Yes, except that the intervals were
different in Disco Fever. They were 16 millisecond
intervals. In the subsequent or Flash and subsequent,
they are 32 millisecond intervals.

Q.   What is the purpose of keeping track of
the time the ball is in play?

A.   It allows the operator to make adjustments
to where the posts are set up in the game in order
to reduce the playing time or the average playing time

of a ball for a given game, which would increase his

profits.

Q   When you say the posts, what do you

mean by that?

A   There are posts on the playfield, and

if I may show you --

Q   BD-101 you are examining?

A   There are posts for example on Page 38,

which are movable. They can be moved up or down.
THERE ARE
They are different positions that they can be placed

in. Depending on where that post is positioned

will determine how often the ball will exit from

that particular side. If a game is -- if each ball

is lasting one minute and it is a three-ball game,

then an average game will last three minutes. The

operator with this particular feature can tell over

a thousand or 2,000 or 5,000 games how long each

game takes in terms of seconds per ball. He can

make these adjustments accordingly to reduce the

time which will increase his profits. So it is a

way for the operator to be able to percentage his

game much more precisely than has been available in

the past.

Q   Are there any other functions that are

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performed by the IRQ beside the one you have

mentioned for the games after Flash?

A.   The IRQ will also do something which was not

done in the previous background or the original back-

ground, and that is it will monitor the lamp PIA

control register. Every single IRQ, it will check

that control register to make sure that it contained

valid information.

Q.   What is the PIA control register?

A.   The control register is the register

in the PIA which establishes whether each of the

ports is an input port or an output port and the

condition of the various control lines. During the

IRQ, we monitor that control register to make sure

that it continues to contain the information which

we want in that control register. This was done

as a safety feature to prevent that particular

circuit on the driver board from, if there is a

failure in the lamp PIA, that particular strobe

which would enable the lamp via blanking is disabled,

so we have added an extra level of intelligence toward

disabling that PIA. The displays could be running

fine, but there could still be a problem with the

lamp PIA, so we are checking the lamp PIA and we

are going to black the lamp PIA out if there is a
problem even though our displays are still working.
It is a safety feature because of our circuit
design, so that was incorporated in this background,
and that was not the case in the previous back-
grounds.

Q.   Do the lamp PIAs contain some device
for indicating that a lamp should be on for any
particular output port?

A.   They contain a register which is loaded
with the information.

Q.   And that registers stays in a certain
state until it is instructed to change?

A.   Until it is instructed to change. That
is the nature of the PIA. That is the way they
work.

Q.   You mentioned this before, I think.
I'm not sure. What is a cycler?

A.   A cycler in our system is a software
definable event which happens at a fixed rate or
fixed interval of time, and can happen for a certain
amount of time or can happen repeatedly. For
example if in the Flash there were five arrows in
front of the targets in front of the five bank.

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There is an arrow -- the arrow is actually cycled from one target to the next. There is another cycler in front of the three bank. Those arrows cycle independently of whatever is going on in the game. That cycling will occur at a fixed rate, which is determined by the foreground.

Q.   Is that done with counters that are counted down?

A.   During the IRQ, that is correct.

Q.   And they are checked when they reach a certain value?

A.   Yes.

Q.   And there are four of those contained in the Flash game?

A.   That is correct.

Q.   Are there any other differences in the functioning of the IRQ from the Flash game from the Disco Fever?

A.   The IRQ will also check to see whether or not a scan kill is requested, in which case it will not scan switches.

The IRQ will also check to see whether or not a group of counters, an additional group of counters has timed out, and if it has,

it will load that particular information or the

information that it is supposed to load or pass

to the ~~exact~~ EXEC (*CPU*) and that allows us then to wait a

fixed amount of time and then perform something.

Q   What are those counters for?

A   Those counters are to do things -- to

do a special effect, for example, for a certain

amount of time.

Q   What type of special effect?

A   In Flash, for example, there are flash

lamps which flash a number of times, and then they

stop flashing. Well the fact that they flash is

because of these counters being decremented, and

once they decrement to zero, then a jump to a

routine is done, which makes the flash, and that

information is reinitialized into the counter and

the jump occurs again until a certain other count

has been satisfied, and then that process ceases.

That is another independent process which is timed

as a result of IRQ.

Q   Is there anything else?

A   I think we have got it all. One other

thing, which does occur is that elements that are

in the switch stack are removed from the switch

stack and put into the switch counters when the switch counters time out, and that is done as a result of IRQ.

Q   Why are they removed from the switch stack and put into the switch counters?

A.   So that they can be acted upon. If the switch counters are busy: i.e., if there are four switches waiting to be timed out, when a valid switch is read it is put on the switch stack. If another switch is read it is put behind that switch on the switch stack. Now the IRQ comes along and one of the switches finally debounces. It removes one of the switches from the switch stack and puts it into the switch counters.

Q   To be operated on.

A.   And then the executive monitors the counters, not the stack, and it will decide when to act upon that switch.

Q   What determines whether the switch scan kill is operated?

A.   The switch kill is performed as a result of information which is either coded in the foreground or the background for a given routine to handle a particular type of switch.

Q.   And so during the IRQ, what causes the
scan kill to be operated?

A.   There is a location which is referred
to as scan kill. When that location is non-zero,
then scanning does not occur and every 16 milli-
seconds that is a counter, and it is counted down.
When it finally reaches zero, then scanning resumes.

Q.   So part of the IRQ routine is to check
that count?

A.   That count.

Q.   And to count it down?

A.   Yes.

Q.   Is there anything else that IRQ performs
that you have not mentioned for the Flash game as
opposed to the Disco Fever?

A.   No, those are the only functions that
I can see that the IRQ does. Now these are all --
I am going to have to qualify that. These are
background functions of the IRQ. It is possible to
add to those functions in the foreground. The
foreground programmer has the capability of trapping
the interrupt service before it actually occurs and
causing it to do something in addition to these
things. That, in fact, is done on certain games.

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Q   Could you give me an example of that?

A   If a particular game, you wanted to use another counter which was not available, you could assign that counter to a certain address in the scratch RAM and then every time through the IRQ, you could count that counter down, as well as all the other counters that are being counted down. Then you could act upon that counter and do something when it goes to zero.

Q   Were there any other changes to the Flash game that we have discussed that you have not -- as opposed to the Disco Fever, that you have not mentioned at this point?

A   Yes, there is one other change and that is during diagnostics, the way in which data was entered into the CMOS memory was changed, and the types of things which were kept track of in the CMOS memory was changed.

Q   Anything else?

A   The only other thing that I could think of is that the new background allows us to interrupt its own flow in the foreground. The old background, or the Disco Fever background, did not have that additional capability: i.e., the background was fixed.

It went through a series of steps and it always went through those steps.

In the new background, the 9233-34, we are capable of vectoring out of the background to a location in the foreground and performing a routine there prior to continuing with the execution of the background, which allows us to alter the flow of the main program. We were not able to do that before.

Q   Were there any design changes that were done after the 9233 and 9234?

A   Design changes in references to software or hardware?

Q   Either.

A   In reference to software, 9233-34 is our current background. So the answer is no.

In reference to hardware, the dash six was the hardware which was designed for the 9233-34 background, and that is also our current system.

Q   So there would be no changes past what we have discussed?

A   Right.

Q   Both hardware and software?

A   There is a proposed version --

MR. GOLDENBERG: I caution you not to

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speak about products in development.

THE WITNESS: Okay, that is the end of

that.

BY MR. SCHNAYER:

Q   Could you continue your thought about

the proposal?

MR. GOLDENBERG: No, I advise the witness

that he is not to continue his thought. It is not

appropriate under the circumstances.

BY MR. SCHNAYER:

Q   Do you take your attorney's instruction?

A   Yes.

Q   Is there a proposal presently for the

revision of the system?

MR. GOLDENBERG: I object to the

question and advise the witness he need not answer

it.

BY MR. SCHNAYER:

Q   Are you familiar with what that proposal

is?

MR. GOLDENBERG: I object to the question

and advise the witness he need not answer.

BY MR. SCHNAYER:

Q   Have there been prototype systems

containing new proposals?

MR. GOLDENBERG: I object to that question and advise the witness he need not answer. Mr. Schnayer, if you are done and you are just harassing the witness here, we will quit the deposition.

MR. SCHNAYER: I am not harassing. This is the last line of questioning.

MR. GOLDENBERG: I'm sorry?

MR. SCHNAYER: This is the last line of questioning. I would like to find out enough answers for the record.

MR. GOLDENBERG: I think you have that. If there is any question, sir, that we simply are not going to permit testimony about present development activities of the defendant. That is all.

MR. SCHNAYER: That concludes my examination. Would you like cross examination of the witness?

MR. GOLDENBERG: I have no questions. I take it signature before any notary is appropriate?

MR. SCHNAYER: Yes.

I would request, of course, that those schematics be made available to us.

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MR. GOLDENBERG: Yes. Mr. Dussault said
he would look for those and send me copies. Send us
two.

FURTHER DEPONENT SAITH NOT.